JOURNAL
OF THE
WASHINGTON ACADEMY OF SCIENCES

VOLUME 40 FEBRUARY 15, 1950 No. 2

ANTHROPOLOGY.—*Early description of lambdoid cranial deformity incorrectly attributed to the Navaho: Historical note on R. W. Shufeldt, M.D. (1850–1934).*[1]

T. D. STEWART, U. S. National Museum.

At a meeting of the Anthropological Society of Washington on November 2, 1886, Prof. Otis T. Mason read a paper entitled "Head Flattening among the Navajos" for an absentee member.[2] The author of the paper, Robert Wilson Shufeldt, was then with the Army at Fort Wingate on the frontier of New Mexico. To judge by the published version of the paper,[3] it consisted of brief reference to two deformed skulls, together with observations on head deformation in the living Navaho. The two skulls already had been described in separate publications (Shufeldt, 1886a and b) in the Journal of Anatomy and Physiology of London. To the description of the first of these skulls, Sir William Turner, a distinguished anthropometrist and one of the editors, had added a note calling attention to the deformity which Shufeldt had completely overlooked. Thus, perhaps it was Sir William's note that led Shufeldt to make an investigation of head flattening among the living Navaho.

Shufeldt's two papers of 1886 are remarkable for containing some unwarranted, though perhaps understandable, assumptions. First of all, there is inadequate proof that the two skulls were those of Navahos. As Shufeldt did not himself collect the specimens, his identification rests mainly on the statements of his collectors. The first skull, he says, "was collected by a young man on one of their burial grounds upon the hills in the vicinity of Fort Wingate..."; the second "was collected in a cañon some 30 miles from Fort Wingate... from a lot of graves there found among the rocks.... My collector informed me that the Navajos had buried a dozen or more of their dead in the same locality..." Although the first statement now suggests the Pueblo mode of burial, the second does indeed suggest the Navaho. The fact that the Navaho were living in the area at the time lent plausibility to both statements. Little had then been published about the Pueblos who had occupied this region at an earlier time, although Bandelier (1892, pp. 343–345) had already examined the ancient ruins about Fort Wingate. Thus the need to differentiate between Navaho and Pueblo was not even considered by Shufeldt.

A second assumption concerns the mode of death exhibited by the first skull. Shufeldt (1886a, p. 426) states that death was caused "by a gun-shot wound of the head." And he goes on to say that—

> The large wound of entrance has pierced the left outer angle of the supraoccipital bone, and destroyed the adjacent mastoidal process of the *pars mastoidea* of the temporal, resulting in a magnificent example of that rare condition, a fracture by *contre coup*, the external appearance of which may be seen upon the right frontal bone of the figures.

Examination of the figures, however, suggests to me that the frontal wound is a

[1] Published by permission of the Secretary of the Smithsonian Institution. Received October 10, 1949.

[2] See note following item 95 in Shufeldt, 1887, p. 15.

[3] The final publication may represent a completely altered version. In the "Abstract of the Proceedings of the Anthropological Society from Nov. 3, 1885, to May 15, 1888" (p. 364) there is a footnote stating that this paper "will be published in the Annual Report of the Smithsonian Institution for 1886." However, the author's bibliography (Shufeldt, 1887, p. 15) states that this paper had been "accepted as a contribution for the Report of the Bureau of Ethnology." Actual publication was in the Popular Science Monthly of 1891.

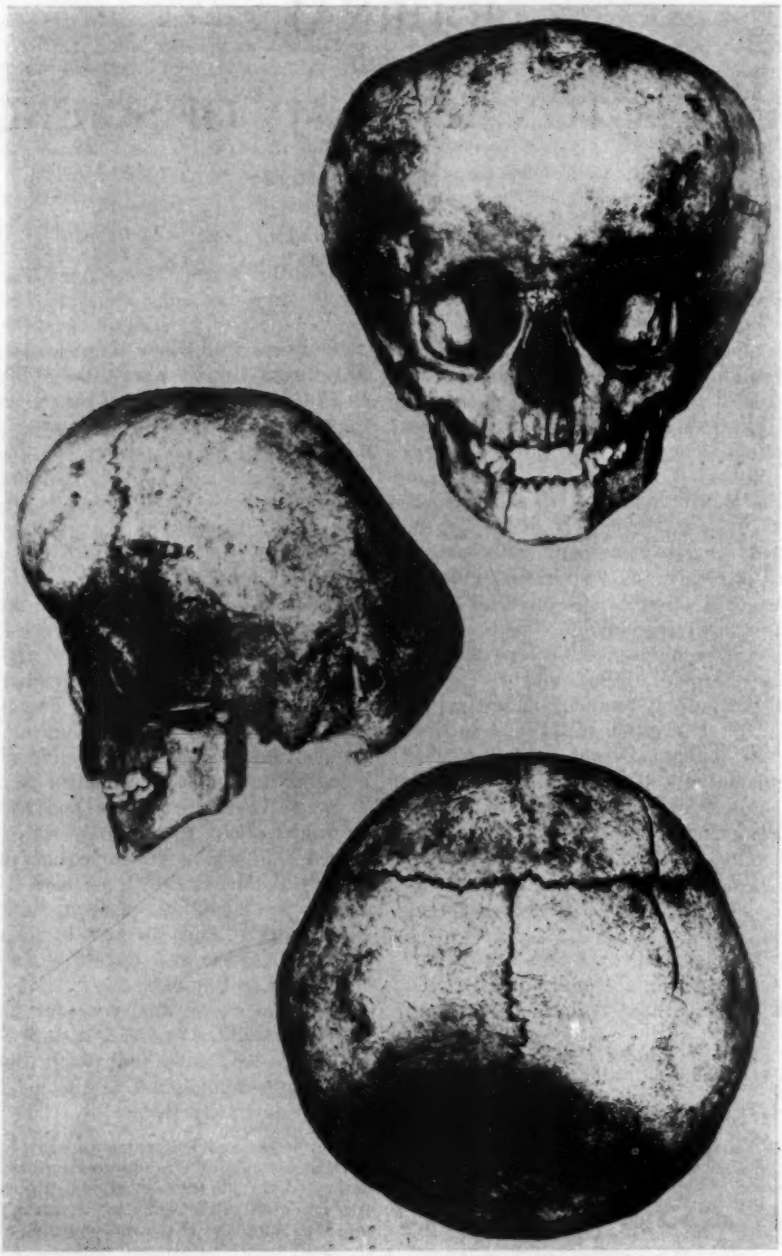


FIG. 1.—Skull XXXII.B.6; child; in Anatomical Museum, University of Edinburgh. Collected near Fort Wingate, N. Mex., and donated by R. W. Shufeldt in 1886. Evidence is presented herewith to show that this is probably not a Navaho, as originally claimed, but a prehistoric Pueblo. Note that extreme lambdoid deformity makes the orientation on the Frankfort horizontal seem unnatural. (Photographs by courtesy of Prof. W. C. Osman Hill.)

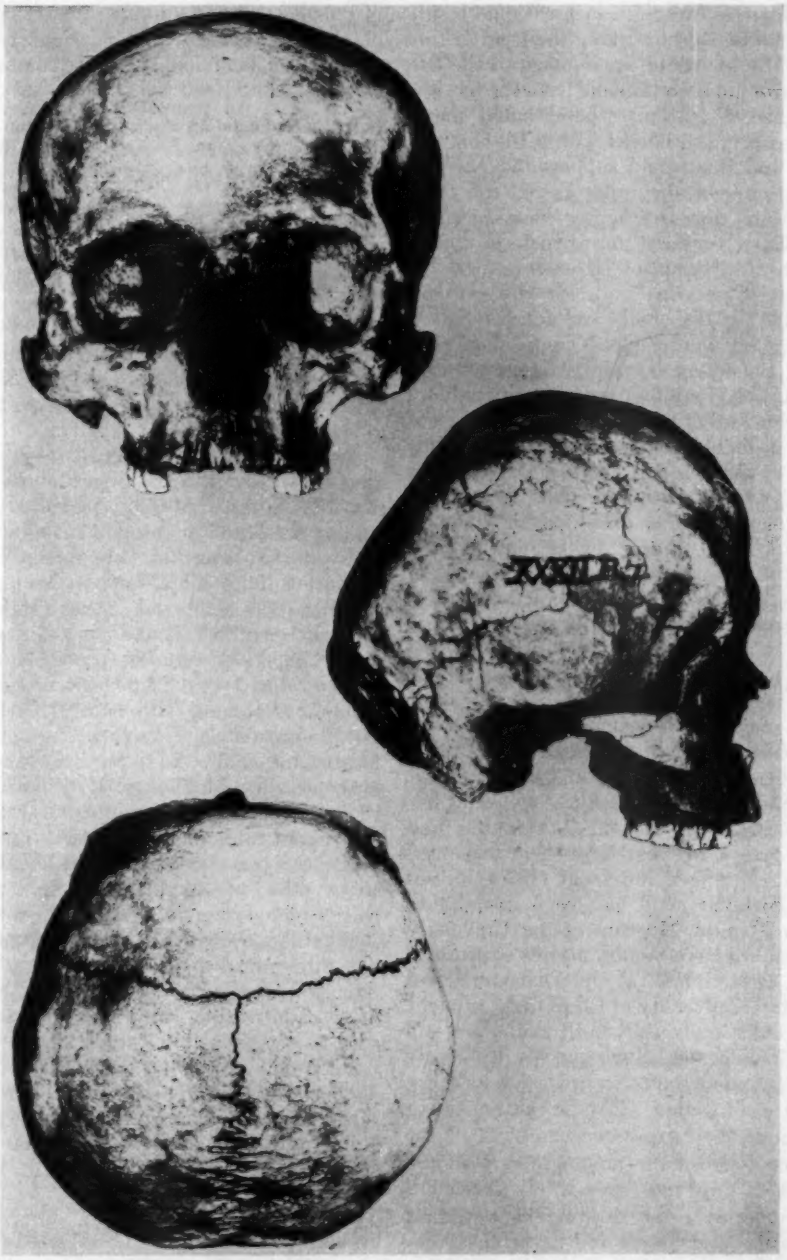


FIG. 2.—Skull XXXII.B.7; adult male; in Anatomical Museum, University of Edinburgh. Collected near Fort Wingate, N. Mex., and donated by R. W. Shufeldt in 1886. Evidence is presented herewith to show that this is probably not a Navaho, as originally claimed, but a prehistoric Pueblo. Note moderate lambdoid deformity. (Photographs by courtesy of Prof. W. C. Osman Hill.)

small depressed fracture such as could result from a blunt object striking the head at this point. The nature of the damage to the left mastoid is not ascertainable from the figures. Of course, a gunshot wound could mean that death had occurred within the historic period and this would support the Navaho attribution. On the other hand, the type of fracture that the figures seem to show could have occurred in prehistoric times.

A third assumption is resorted to by Shufeldt to account both for the extreme deformity in the skulls and for his failure to find more than slight occipital flattening among the living Navaho. His assumption is that they had practiced intentional deformation earlier but had given it up before the time of his observations. Nothing was found in the cradling practice then current to support this idea. Moreover, if such extreme deformity as exhibited in the two skulls was no longer to be encountered among the living, this suggests the lapse of a considerable time interval. If such were the case, then it seems likely that the burial places of these former inhabitants would no longer have been known to the local people.

The case against Shufeldt's tribal attribution required, it seemed to me, a re-examination of the skulls themselves. Otherwise there is nothing upon which to base an opinion, except Shufeldt's obviously imperfect drawings. But first the skulls had to be located. My search for them was aided by Shufeldt's own statement (1886b, p. 66) that the adult skull had been donated to the Anatomical Museum of the University of Edinburgh. An inquiry addressed to Prof. W. C. Osman Hill, of the Department of Anatomy, University of Edinburgh, brought the prompt reply that both skulls are still in their collection. Subsequently he kindly sent the photographs reproduced in Figs. 1 and 2, together with an authoritative opinion on the "gun-shot wound."

Comparison of the photographs with the published drawings reveals, as expected, some defects in the drawings but verifies the nature and extent of the artificial deformity. The designation used today for this kind of deformity is "lambdoid." Our present knowledge of this type of deformity in the Southwest comes entirely from collections of Pueblo skulls. In a recent (1949) summary of the geographical and chronological distribution of lambdoid deformity among the Pueblos, Erik Reed has this to say:

> Artificial lambdoid skull-flattening can be delimited in both time and space—between 700 A.D., or somewhat later, and approximately 1300 A.D.; from the upper Rio Grande [in New Mexico] to the lower Virgin River [in southeastern Nevada] and from the Little Colorado area, including the vicinity of Flagstaff [Arizona], to the northern boundary of the Pueblo domain in Utah and southwestern Colorado. (p. 115.)

Fort Wingate, from the vicinity of which Shufeldt's two skulls came, is within these boundaries. Moreover, as already indicated, it is well established that there are old Pueblo ruins in this vicinity.

On the other hand, it must be admitted that still very little is known about early Navaho skulls. Malcolm (1939) reported finding the burial of an adult male in Chaco Canyon that was "of undoubted Navaho origin but quite old." Donovan Senter, who examined the skull, states that "there was a slight artificial lambdoid deformation" (Malcolm, 1939, ftn. 28, p. 16). I should like to be sure that Senter did not confuse artificial flattening with natural flattening, but unfortunately I have been unable to locate this skull. Nor can I locate other authentically old Navaho skulls. The fact remains, therefore, that Shufeldt's two skulls are about the only evidence that the Navahos practiced lambdoid deformity. From other considerations given herewith this is not very good evidence.

Like the drawings, the photographs do not throw much light on the nature of the damage to the frontal and mastoidal regions of the adult skull. However, Professor Hill was good enough to furnish me with an opinion obtained by his assistant, Dr. Hugh Taylor, from Sir Sydney Smith, professor of forensic medicine at the University of Edinburgh, and the latter's assistant, Dr. Fiddes. In their opinion, writes Dr. Taylor:

> . . the damage done to the frontal area was *not* due to any gunshot wound either by "contre coup" or directly. . . . In addition, they both doubt whether the "large wound of entrance" was caused by a gunshot wound at all. This opinion was based on their knowledge of the known types of apertures made by gunshot wounds. Dr. Fiddes also pointed out that this skull was covered with

"adipocere"—a substance found in skulls which lie buried for some time in soil—except on the edges of this large aperture. From this he concluded that the aperture was probably made either as the skull was being removed from the soil, or after it had been removed.

In the light of these facts, and the developments during the 60-odd years since Shufeldt wrote, the two skulls that he labeled Navaho seem more likely to be Pueblo.[4] The indications that the Navaho did not practice the lambdoid type of deformity exhibited in these skulls, whereas the prehistoric Pueblos around Fort Wingate did, favors a prehistoric dating. In addition, the refuted diagnosis of gunshot wound may likewise mean that these skulls date back to a prehistoric period. Essentially therefore, the tribal identification of these skulls rests upon the statements of untrained collectors.

It is to be hoped that future bibliographers will clarify the nature of these references. Otherwise they will continue to mislead the unwary reader seeking information on the Navaho. Dingwall, for example, who wrote a book (1931) on the world-wide distribution of artificial cranial deformation, has referred therein to Shufeldt's first paper and Turner's note thereon. And the latest special bibliography on the Navaho (Kluckhohn and Spencer, 1940), as well as the foremost general ethnographic bibliography (Murdock, 1941), includes this whole series of references.

In my opinion the main contribution of Shufeldt and Turner in these papers, although admittedly little use has been made of it, was to provide an early description of lambdoid deformity. However, theirs was not the earliest. This honor goes, so far as I can discover, to W. J. Hoffman eight years earlier (1878). The specimen described by Hoffman, usually considered to be a Pueblo, came from the Chaco Canyon, which is around 50 miles northeast of Fort Wingate.

[4] Because of individual variation, the facial proportions in the adult are not helpful for purposes of tribal distinction.

LITERATURE CITED

ANONYMOUS. *Abstract of the Proceedings of the Anthropological Society [of Washington] from Nov. 3, 1885, to May 15, 1888.* Amer. Anthrop. **1**: 361–371. 1888.

BANDELIER, A. F. *Final report of investigations among the Indians of the Southwestern United States, carried on mainly in the years from 1880 to 1885.* Papers Archaeol. Inst. Amer., Amer. ser. no. 4, pt. 2, 591 pp. 1892.

DINGWALL, ERIC JOHN. *Artificial cranial deformation. A contribution to the study of ethnic mutilations.* London, 1931.

HOFFMAN, W. J. *Report on the Chaco cranium.* 10th Ann. Rep. U. S. Geol. and Geogr. Surv. . . . for the year 1876: 453–457. 1878.

KLUCKHOHN, CLYDE, AND SPENCER, KATHERINE. *A bibliography of the Navaho Indians.* New York, 1940.

MALCOLM, ROY L. *Archaeological remains, supposedly Navaho, from Chaco Canyon, New Mexico.* Amer. Antiq. **5**: 4–20. 1939.

MURDOCK, GEORGE PETER. *Ethnographic bibliography of North America.* Yale Anthrop. Stud. **1**: xvi + 168 pp. 1941.

REED, ERIK K. *The significance of skull deformation in the Southwest.* El Palacio **56**: 106–119. 1949.

SHUFELDT, R. W. *A Navajo skull.* Journ. Anat. and Physiol. (London) **20**: 426–429. 1886a.

———. *A skull of a Navaho child.* Journ. Anat. and Physiol. **21**: 66–71. 1886b.

———. *Contribution to science and bibliographic résumé of the writings of R. W. Shufeldt, M.D. 1881–1887.* New York, 1887.

———. *Head-flattening as seen among the Navajo Indians.* Popular Sci. Mon. **39**: 535–539. 1891.

TURNER, SIR WILLIAM. *Additional note on the Navajo Indian skull.* Journ. Anat. and Physiol. **20**: 430–431. 1886.

ETHNOLOGY.—*Bird nomenclature and principles of avian taxonomy of the Blackfeet Indians.*[1] CLAUDE E. SCHAEFFER, Museum of the Plains Indian, Browning, Mont. (Communicated by JOHN C. EWERS.)

The present paper comprises the preliminary results of a program of ethnobiological research now being carried on by the Museum of the Plains Indian among the Blackfeet Indians of Montana. As a field of inquiry, the relationships between man and nature in the Northwestern Plains and the traditional native ideologies built up around its biota offer much to enrich our understanding of the resident Indian cultures. In this study attention is confined to Blackfeet ornithology and, more narrowly, to the nomenclatorial phase of that topic. The rest of the material collected on Blackfeet bird

[1] Received September 6, 1949.

knowledge, including the economic importance of wildfowl, methods of taking, birds as pets, socioceremonial aspects, and the whole structure of avian folklore, has been set aside for presentation at a later date.

The Piegan, or southernmost Blackfeet tribe, have occupied the short-grass plains of northwestern Montana from as early, at least, as the beginning of the nineteenth century. As Saunders (p. 9) has pointed out, the plains, most of the mountain valleys, and all the lower slopes and canyons of this region are located in the Transition Life Zone. Within this zone the same author (pp. 12–26) has tentatively demarcated a number of faunal associational areas—grasslands, lakes, marshes, thickets, etc.—each with its characteristic assemblage of bird forms. Westward the Hudsonian, Canadian, and Arctic-Alpine Zones at successively higher elevations of the Rockies are distinguished, in turn, by different groups of tree-dwelling species. As a result, the avian life of the Piegan country is both varied and abundant.

The same life-zone pattern can be extended northward into Canada, presumably with slight if any change in faunal types, to include the tribal territories of the Blood and Blackfeet proper. In Alberta and Saskatchewan the plains south of the North Sasketchewan River represent the earliest known hearth of Blackfeet culture (Ewers, p. 9). Throughout the period of their recorded history, the three tribes have resided continuously within the Transition Zone. Their long acquaintance with plains-dwelling bird species is reflected, accordingly, in Blackfeet terminology.

My ornithological notes were collected during the winter and spring of 1948–49 from southern Piegan sources in and about Browning, Mont. Most of the data came from Jim White Calf (WC), age 85; Richard Sanderville (RS), age 83; and Wallace Night Gun (NG), age 76. White Calf was not only versed in native bird lore, but his ownership of the Beaver Bundle made him conversant with ceremonial aspects of the topic.[2] He was acquainted with the names of about 70 species. Sanderville, as the result of a life long interest in Blackfeet culture and history, had accumulated a fund of knowledge on the avian world. He was familiar with the names of about 60 species. Night Gun's knowledge was less extensive, but he proved useful in checking the statements of others. Less frequently and for shorter intervals, the services of Weasel Tail (WT), age about 90, Green Grass Bull (GB), age 86, and Short Face (SF), age 78, were utilized for information on various points. Their knowledge was about equal to Night Gun's. My interpreter was George Bull Child. An opportunity to compare Blood nomenclature with that of the Piegan was presented in the person of Harry Under Mouse (UM), age 58. This informant had grown up on the Blood Reserve, in Canada, and possessed a fair knowledge of the ornithology of that group. From his statements it appears that such differences as may formerly have existed between the two tribes were relatively minor and unimportant.

The procedures employed in identification deserve comment here. Black-and-white and colored bird plates ordinarily utilized for this purpose proved inadequate among elderly Blackfeet, many of whom are illiterate and handicapped by poor vision as well. Another method, supplemented by illustrations (Pearson; Peterson) and verbal descriptions, provided more satisfactory results. It consisted of submitting a series of prepared bird skins[3] to informants for detailed examination and comment.[4] Skins of 107 different species were chosen from the total of 332 known to occur throughout the State. Selection of skins was arbitrary but included representative varieties of the plains and mountains of northwestern Mon-

[2] Today (and possibly in earlier days) the greater part of Blackfeet faunal lore is in the possession of certain Medicine Bundle ritualists, who recapitulate the traditional knowledge of their forebears during the formal opening of the bundles.

[3] The prepared bird skins were secured on loan from Washington State Museum, Seattle. The assistance of Dr. Erna Gunther, director, in making available the Museum's ornithological collections is gratefully acknowledged. I am also indebted to Mrs. Martha Flahaut, curator of biology, for advice on points of bird distribution, behavior, and source material.

[4] This procedure conforms with a pre-established pattern of Blackfeet ceremonialism, in which animal and bird skins from certain medicine bundles are handled in ritualistic ways, usually in mimetic dance and song contexts. See Wissler, p. 168 ff.

tana, plus a few from adjacent faunal provinces. This material was presented in groups of related species, so that intrafamily comparisons of size, proportion, and color could be made. Omitted for reasons of packing and shipment were specimens of the larger birds, such as the eagle, vulture, swan, ducks, etc. Most of these species were so distinctive, in form or habit, that reliable identification was made in other ways. The disadvantages of this method were the absence of specific behavioral traits (posture, gait, flight, song), upon which native terminology is often based.

The scope of the study was widened, historically, by reference to lists of Blackfeet bird names collected over a period of more than a century by various white observers. The earliest known data, consisting of less than a dozen terms, were gathered by the fur trader Alexander Henry (Coues, vol. 2, pp. 534–538), presumably from native sources on the upper Saskatchewan River prior to 1811. Henry's terms, except for one, are recognizable by modern Blackfeet and approximate contemporary referents to the species indicated. A half century later, F. V. Hayden (p. 265), who accompanied several exploring expeditions to the upper Missouri (1854–60), compiled an important list of 35 bird names. In the case of Hayden's material, it is not always possible to equate his English equivalents with those of modern ornithologists. McClintock (1910; 1923), starting in 1896, accumulated a quantity of information on Blackfeet life, which contains scattered references to bird names and bird lore. The most recent material is that recorded in 1910–11 by de Josselin de Jong and Uhlenbeck during the course of their linguistic studies among the Southern Piegan.[5] Data from these different sources provide a rough cross section of Blackfeet nomenclature at various time periods and serve as a comparative check upon modern Reservation knowledge.

The Blackfeet generic term for bird, particularly of the larger species, is *piksi* (Henry: peeksue).[6] The etymology of this word is obscure, but to modern Indians it conveys the sense of "magical" or "wonderful," possibly in reference to avian powers of flight. A comparable designation for the smaller birds is *sistsí*. The latter is frequently, and the former more rarely, combined with different adjectival prefixes to form the names of various species. Possibly both terms are onomatopoeic in origin. A separate term *póksistsi*, "small *sistsí*," is reserved for the less brightly colored varieties, such as the sparrows, etc.

The bird names of the Blackfeet are set forth below. My identifications and terminology are chiefly based upon those listed in Peterson (1941). Where the native term is applied to an entire family rather than a particular species, I have indicated that fact in the use of the scientific term.

Matsítsaipi, "fine charger," loon (Gaviidae). The term refers to the loon's habit of extending and flapping its wings on the water. The Blackfeet interpret this behavior metaphorically, in terms of their war tactics. Some informants (WC; NG) also extend the term to the merganser.

Mikskístaii, "fine diver"; *apatsésstika*, "legs grow backward," grebe (Colymbidae). The extreme posterior placement of the grebe's legs is responsible for the latter term. Known locally as helldiver.

Soχkaúkomi, "big throat"; *aiistpissa*, "carries water," white pelican (*Pelecanus erythrorhynchos*). Reference is made to the appearance and alleged function of the capacious throat pouch.

Moχkámi, great blue heron (*Ardea herodias* subsp.). A mimetic term regarded as a close reproduction of the species' low, hoarse croaks. One source (UG, p. 157) defines the word as pelican. Since my informants' descriptions indicate the heron, and other terms exist for the pelican, the former appears to be the bird in question. Confusion exists among many bilingual Blackfeet as to the correct English names for these and other bird species, a situation responsible, I believe, for the above error.

[5] Uhlenbeck and van Gulick, abbreviated as UG in text reference. The above-noted linguists gathered a considerable number of bird names, which are referred to only if they diverge from my own data.

[6] The system of recording native terms employed by Uhlenbeck and van Gulick (pp. 7–8) is followed in my own text renderings. In general, the vowels and consonants have nearly their continental values, with *a* expressing the *u* sound in English *but*; Greek *χ* the guttural, nonpalatized fricative; and *x* the palatal voiceless fricative.

Itápksissi natosi, "pointing beak to the sun"; *natoípiksi*, "sacred bird," American bittern (*Botaurus lentiginosus*). The first name is based upon a well-known habit of the bittern. Upon alighting at its nest the bird, according to native belief, points its beak toward the sun and follows its course throughout the day. The latter term represents a later interpretation consonant perhaps with an increasing Blackfeet emphasis upon the Sun as the supreme spiritual power.

Imíχkaii, "going home"; *ksikómaχkaii*, "white going home," swan (Cygninae). Both terms refer to the swan in migrant status. Henry: *omakaiye*.[7]

The ducks and geese are classified as *sée*, a term modern Blackfeet are unable to define. That it had much the same application more than a century ago is evident from Henry's *sahesk*, "goose," and *sahesh* or *sihow*, "duck." The word *sée* is combined in one instance with a prefixed element to form the name for the merganser. The subfamilies of ducks are known generically by the designation *méksikatsi*, "red feet." Hayden's term for teal duck, *piksikáci*, is probably equivalent. Large ducks (*omaχséksikatsi*), such as the mallard, are distinguished as such from the smaller varieties (*inakséksikatsi*), as the teal. I could obtain no further data on differentiation of species.

Ápspini, "white cheeks," Canada goose (*Branta canadensis* subsp.). Hayden: *apspíni*, common wild goose; UG (p. 98) *saiai*, *ápspini*, goose.

Iínoχksikanikim, "dark-tipped feathers," snow goose (*Chen* sp.). UG (p. 33) gives this term for brant.

Misée, "hardy *sée*," merganser (Merginae). Hayden: *miésa*, fish duck. Term assigned for reason of the merganser's ability (1) to winter in northern latitudes, or (2) to submerge for long periods. This bird group is confused, terminologically, both with the grebes (WC) and the bitterns (WC).

Píkoki, "scabby head," turkey vulture (*Cathartes aura*). Hayden's term, *sikaí*, is unfamiliar to my informants.[8]

Omaχsapítau, "big eagle," California condor (*Gymnogyps californianus*). Evidence for the occurrence of the condor as a rare, extralimital wanderer in the Browning area is being prepared in a separate paper.

Pítau, eagle, especially the golden eagle (*Aquila chrysaëtos canadensis*). Henry: *peeta*; Hayden: *pitáo*, war eagle. An archaic term. It suggests today the sense of proud or "beautiful." Hayden's *isisúnikim* ["dark speckled feathers"] and *sikitsinaíaks* ["black shin"], black eagle, are both said to refer to the golden eagle in adult plumage.

Ksikixkíni, "white head," bald eagle (*Haliaeetus leucocephalus* subsp.). The *sekakineoa* of McClintock (1910, p. 484) is evidently a phonetic variant transcription.

The hawks are known collectively as *aiinnimaíaks*, "seizers." One source (UG, p. 46) gives this as the name for chicken hawk. Of the considerable number of species in this general area, seven are distinguished by individual native terms. The goshawk and duck hawk, as represented by prepared skins, are unfamiliar to most informants. However, these are included with the prairie falcon, sharp-shinned hawk, and Cooper's hawk in the category of *omaχsistsípanikim*, "large barred feathers." Through an oversight the prepared skin of the pigeon hawk was not shown to informants. Hence the designation of that species can not be given.

Pispsksí, "high," sparrow hawk (*Falco sparverius* subsp.). The term has some now unknown reference to the bird's flight.

Omaχsapíspsksi, "big *pispsksí*", sharp-shinned hawk (*Accipiter velox*).

Otaχkúksoats, "yellow tailfeathers"; *ksikápitapanikim*, "real white feathers," redtail hawk (*Buteo borealis* subsp.). The tailfeathers of this species are said by the Blackfeet to change color seasonally. Hence the former term is applied to the bird in winter; the latter in summer. Hayden: *sikúpetapunikimi*, gray hawk [?].

Sikpuítapanikim, "dark greasy feathers"; *isikaúkaii*, "black breast," Swainson's hawk (*Buteo swainsoni*). Hayden's *siketapunikimi* ["dark real feathers"], brown fish hawk, is tentatively equated by informants with this species. The latter term is applied also to the chestnut-collared longspur.

Ikpaksoátsimiop, "resemble (eagle) tailfeathers," American rough-legged hawk (*Buteo regalis*). The tailfeather markings of this bird are said to

[7] Through a typographical error the English identification of this term in Henry's list has been transposed to the line below.

[8] Blackfeet traditions remark the former abundance of the vulture and its feeding upon the carcasses of bison. Today it is rarely, if ever, seen about the Reservation. A similar decrease in the vulture population seems to have taken place throughout the state. Cameron (p. 259) quotes an early resident of eastern Montana, who attested to the abundance of the species in 1883, attracted by the prodigious slaughter of the bison. Thereafter, a rapid decline took place until by 1905 they had become accidental wanderers.

be such as to permit substitution of the feathers for those of the eagle in men's headdresses.

Apipisioxsi, "white belt," marsh hawk (*Circus hudsonius*).

Paχtsíksistsikum, "false thunder," osprey (*Pandion haliaetus carolinensis*). The term is echoic of the sound made by the bird's wings during its flight dive. Informants are not familiar with Hayden's term *apetapúnikimi* ["light-colored feathers"], fish hawk.

Kitssítsum, "looks like smoke," Franklin grouse (*Canachites franklini*); ruffed grouse (*Bonasa umbellus* subsp.). These two birds are differentiated by the descriptive adjectives *matsápsi*, "crazy," applied to *Canachites*, and *ápaskau*, "dancer," to *Bonasa*. Hayden: *kitsiitsim*, pheasant.

Omaχtsikítssitsum, "big *kitssítsum*," Richardson's grouse (*Dendragapus obscurus* subsp.).

Kétoki, "tough skin," sharp-tailed grouse (*Pediocetes phasianellus* subsp.). The significance of the name has been lost, but it may be mimetic in origin. Hayden: *kítoki*, common prairie hen.

Apikétoki, "white *kétoki*," white-tailed ptarmigan (*Lagopus leucurus* subsp.).

Omaχsakétoki, "big *kétoki*," sage hen (*Centrocircus urophasianus*). Hayden: *omuksikítoki*, large prairie hen, sage cock.

Sékam, an archaic term now believed to refer to "long legs," crane (Gruidae); *apssékam*, "white *sékam*," probably the whooping crane (*Grus americana*). Henry's term, *oopa*, is not recognized by my informants.

Otoxtoí, "carrying food," sora (*Porzana carolina*), possibly Virginia rail (*Rallus limicola limicola*). The name has some reference to the sora's packing food on its migration ride atop the back of larger waterfowl.

Aksíksksissi, "white beak," coot (*Fulica americana*).

Considerable confusion exists in the minds of the Blackfeet regarding the names and identities of the shorebirds. The same incertitude is evident in McClintock's data and may well go back to aboriginal times. Consequently, I have not been able to resolve present-day inconsistencies or equate modern terms with those of earlier observers. McClintock, possibly, and Hayden, probably, collected their terminologies on the basis of actual field identification. Hence the lack of correspondence between their lists and those of today is, most likely, to be charged against native inconsistency.

Soiatáksa, "shadow in the water"; *apitsótoii*, "removes something from the water," killdeer (*Oxyechus vociferus vociferus*) and semipalmated plover (*Charadrius semipalmatus*). Informants state that either name is applied indiscriminately to the two species. The latter term is said to be mimetic, but both are now interpreted in connection with an alleged bestowal of a medicine bundle by the Underwater Spirits. McClintock (1910, p. 483), states that *soyatakskan* refers to the snipe; in 1923 (p. 227), however, he related it to an odd combination of "a bird with long legs and black breast (spotted sandpiper)." Hayden does not give the name at all. The latter, however, identifies *apitsótoyi* merely as "a small prairie plover"; while McClintock, in his earlier work (p. 483), states that *ma-pit-so-to-e* is "a little smaller than a killdeer, but of nearly the same color." Hayden's related term, *amúkopitsótoyi*, a large prairie plover, is not recognized by my informants.

Kítsipitsikuyi, *kítsipitsikoan*, "hard to see young ones," upland plover (*Bartramia longicauda*). These terms presumably refer to the protective coloration of the plover fledglings. Hayden cites the term without identification; McClintock (1910, p. 483) refers it to the killdeer.

Sotamstá, "rain maker," Wilson's snipe (*Capella gallinago delicata*). Origin of the name is assigned to the snipe's peculiar, circling, mating flight, which the Blackfeet say takes place during or after a rain. One source (UG, p. 29) refers the term to "a species the size of a blackbird with white stripes on tail."

Makénimau, "burial lodge," curlew (Scolopacidae). The origin of the name today is assigned either to (1) the curlew's habit of seeking insects formerly within abandoned burial lodges (RS), or (2) an alleged incident in which a medicine bundle containing the beak of a curlew was recovered from a burial tipi (NG).[9]

Otaχkuíka, "yellow legs," yellowlegs (*Totanus* sp.). The species is known to most informants, but only Under Mouse is familiar with its native name.

Aχkyókenimau, "water *makénimau*," avocet (*Recurvirostra americana*). Although other informants had seen the species, White Calf alone is familiar with the native name.

[9] The term *makénimau* is also applied to the Museum of the Plains Indian by contemporary Blackfeet, because it serves as a repository for material culture items belonging to individuals now deceased.

Apauzkomíi, "white throat," Wilson's phalarope (*Steganopus tricolor*). Another term known only to Under Mouse.

Kaíi, gull (Larinae), probably the ring-billed species. A term now translated as "(porcupine) quill" but possibly onomatopoeic in origin. Hayden gives *kaíyi*, a kind of gull, and *omuksákaiyi*, a large gull. The latter term may refer to the herring gull.

Omaχsíksakapansi, "big *siksakapánsi*"; *axkyómaχsiksakapansi*, "big water *siksakapánsi*," tern (Sterninae), probably the black tern. The swallowlike characteristics of this bird appeal as much to the Blackfeet, terminologically, as to a modern ornithologist (H. K. Job, in Pearson, sect. 1, p. 67).

Káko, *saukyékako*, "prairie *káko*," mourning dove (*Zenaidura macroura marginella*) and domestic pigeon (*Columba livia*). The former term is mimetic.[10]

Sépisto, "night announcer"; *kakanotstóki*, "hollow ear," horned owl (*Bubo virginianus* subsp.). The former, which is also the generic term for the owls, has been characterized as a haplological dissimulation for **sepipistó*, "night nighthawk" (UG, pp. 153–54). The latter name is onomatopoeic. McClintock (1923, p. 114) erroneously translates it as "ears far apart." A variant for the same species is *mispiksíkakanotstoki*, "thick hollow ear," also echoic in origin.

Apsépisto, "white *sépisto*, snowy owl (*Nyctea nyctea*).

Spópiu, "alights on high," hawk owl (*Surnia ulula caparoch*). Named from its habit of flying low over the ground and swooping up sharply to alight in a tree top. One informant (RS) equates this species, terminologically, with the sharp-shinned hawk.

Atsítsi, "mitten," pygmy owl (*Glaucidium gnoma* subsp.). The name is likely derived from the final "two or three slow deliberate notes" (Peterson) of the bird's call. The Blackfeet, however, interpret it from the notion that a person can seize the owl, which is either so unwary or so blind in daylight, by approaching slowly with outstretched hand or "mitten," and calling softly, *atsítsi! atsítsi!*

Matási, "hollowed-out rectum," burrowing owl (*Speotyto cunicularia hypugaea*). Like the previous species, the name of this owl may have had its origin in onomatopoeia.

Paχtsisépisto, "imitation" or "false *sépisto*," long-eared owl (*Asio wilsonianus*). The size of this species led the Blackfeet to consider it a small replica of the horned owl.

Saukyesépisto, "prairie *sépisto*," short-eared owl (*Asio flammeus flammeus*).

Pistó, nighthawk (*Chordeiles minor* subsp.). Informants attempt to relate this term to the sound of the bird's flight dive. Its resemblance to the common Northeastern-Central Algonkian echoic designation (Speck, p. 256), however, suggests a similar origin in this case. The nighthawk is considered lazy because it does not build a nest like other birds but lays its eggs on the ground.[11]

Namotsistsi, "wasp bird," hummingbird (Trochilidae). The term is said to be derived from the hummingbird's resemblance to the wasp or bee.

Auaksauáni, "(pine) gum eater"; *kitsipaúkaii*, "striped breast"; *mamieínima*, "fish catcher"; *apkoχkíniyi*, "white neck," kingfisher (*Megaceryle alcyon* subsp.). These names are all except the first descriptive of the appearance or activity of the kingfisher. It is usually explained by reference to an incident in which pine gum was found within the bird's stomach. My interpreter, however, thinks the term might refer to the wingbeat tempo of the kingfisher. The first name, which is also a variant for Clark's nutcracker, is most commonly used today.

Mékanikesuyi, "flashes red feathers," red-shafted flicker (*Colaptes cafer* subsp.). One source (UG, p. 174) gives "red woodpecker." The generic term for the woodpeckers is *páχpaksksissi*, "pounding nose."

Míkimata, "fire-reddened breast," red-headed woodpecker (*Melanerpes erythrocephalus*) and red-naped sapsucker (*Sphyrapicus varius nuchalis*). Hayden gives for the same term "a kind of small, speckled woodpecker." A variant for the former species is *ekotsótokan*, "red head."

Omaχsíkimata, "big *míkimata*," Lewis's woodpecker (*Asyndesmus lewis*). For this term Hayden gives "red-headed woodpecker."

[10] Possibly this same term may have been extended to the passenger pigeon, although I came across no native traditions relating to it. Saunders (p. 171) notes that this species was "formerly an abundant migrant, evidently throughout the state, and probably breeding in the northern mountains." In this connection, the above-noted variant, "prairie dove," may have served to differentiate in some way the dove and the pigeon.

[11] The similarity of *pistó* to another Blackfeet word, *pístsit*, "to break wind," provides material for native punsters in folklore and conversation.

Siksíkanikesuyi, "flashes black feathers"; *oksíxkini*, "raw head," pileolated woodpecker (*Dryocopus pileatus picinus*). Hayden merely refers the name to "a black woodpecker."

Otaχkúnski, "yellow forehead," Arctic three-toed woodpecker (*Picoides arcticus*).

Sikiminíwani, "stingy with his berries," kingbird (Tyrannidae). The term, which reflects the aggressive qualities of the kingbird, is said to have its origin in a tale in which this bird frightened a bear from its berry patch.

Miátsi, horned lark (Alaudidae). The term is archaic and may originally have been imitative of the bird's call note. Hayden: *niátsi*, killdeer plover [?]. See chestnut-collared longspur.

Siksakapánsi, swallow (Hirundinidae). A difficult term to translate. My interpreter suggests the lexical elements *siksiksi*, "willow tanned hide," and *apansi*, "shows something on self." An earlier translation, "mud shows in beak," was rejected as incorrect.

Apiakúnski, "white forehead," Rocky Mountain jay (*Perisoreus canadensis capitalis*). The Blackfeet consider the male jay and the male nutcracker as male and female, respectively, of one species.

Makokím, "old lodge-cover (color)"; *auaksaudni*," (pine) gum eater," Clark's nutcracker (*Nucifraga columbiana*). The second term is based on the bird's alleged habit of feeding upon pine gum.

Omaχkútskuisistsi, "large *ótskuisistsi*"; *ótskuipiksi*, *ótskuisistsi*, "blue bird," Steller's jay (*Cyanocitta stelleri* subsp.). The last term is also applied to the bluebird (*Sialia*), the lazuli bunting (*Passerina amoena*), and other small birds of blue plumage.

Mamiátsikimi, "body like a fish," magpie (*Pica pica hudsonia*). Hayden: *mámaacíkim*. Henry's *wastoonah*, which my informants heard as *maistoína*, "Crow chief," is interesting as an earlier designation for the magpie.

Maistó, meaning unexplainable, crow (*Corvus brachyrhynchos* subsp.). Henry: *wasto*; Hayden: *másto*, beaver [sic].

Ómaχkaisto, "big *maistó*, raven (*Corvus corax* subsp.).

Népumaki, chickadee (*Penthestes* sp.). The name is onomatopoeic but reinterpreted today as "summer woman." Hayden assigns it to the tomtit. Another source (UG, p. 208) defines the word as "spring bird." The designation *nepe-e*, which my informants claim is an abbreviated form of the above, is referred to the white-throated sparrow by McClintock (1910, p. 482).

Íksisakum, "meat," water ouzel (*Cinclus mexicanus unicolor*). The term may be mimetic in origin. Upon sighting this bird the Blackfeet, however, call *íksisakum! íksisakum!*, and it is said to dip in response. McClintock (1910, p. 483) refers the name to the ouzel but subsequently (1923, p. 185) transfers it to the sandpiper.

Mataksissáxkima, "uses nose to push out (nest)"; *istsikinipitsi*, "sings continuously," wren (Troglodytidae). The former term refers to the nest-building activities of the wren.

Pokaú, "child," catbird (*Dumetella carolinensis*). The term reflects the Blackfeet interpretation of the bird's cry as *na'á*, "mother."

Otaχkaúkaii, "yellow breast"; *otsisaúye*, "colored feathers," robin (*Turdus migratorius* subsp.). The latter name, more commonly used in earlier days, has now been displaced by the former. The robin's presence and song in days of tribal warfare indicated to the Blackfeet that the camp was peaceful and secure. Hence, its departure in the fall was observed with a feeling of regret.

Naistuiksíksoatsis, "white outside tail feathers," Townsend's solitaire (*Myadestes townsendi*).

Simítsima, "lodge-cover pole," waxwing (*Bombycilla* sp.). The Blackfeet lodge consists of a conical structure of poles enclosed by a hide cover secured to the tallest pole. The waxwing's name derives from the fancied appearance of its crest to this pole with its suspended lodge cover. In earlier times waxwings are said to have perched atop the lodge poles of winter camps.

Soχksísmistau, "makes (nest) like a big anus"; *matsaiíki*, "beautiful whistler," western meadowlark (*Sturnella neglecta*). The former is said to refer to the peculiar arched entrance of grass leading to the bird's nest; a somewhat different translation of the term is given by McClintock (1910, p. 482). The latter name is mimetic. McClintock (1910, p. 482) also gives o-toch-koki [*otaχkaúkaii*], "yellow breast," as a variant. The Blackfeet claim to understand the calls of the meadowlark. Among the native interpretations are *kinakíni otsitotsínnaiyixpi*, "where there's fat on the liver"; *kitákema* (*nitákema*) *siksistókiwa*, "your (my) sister's black skin"; *ekyotsítsini*, "roof of mouth is red"; *matsiíkiwa sikimákewa*, "good whistler (is a) stingy woman." All these expressions are mildly derisive in character.

Kseiní, cowbird (*Molothrus ater* subsp.) and

Brewer's blackbird (*Euphagus cyanocephalus* subsp.). Hayden: *kséni*, cow bunting; UG (p. 30): *kseni*, *kseiní*, blackbird. The bronze grackle, *omaχsákseini*, "big *kseiní*" (*Quiscalus quiscula aeneus*), is considered a closely related member of this group. Hayden: *omuksákseni*, crow blackbird. Some informants regard the grackle as male and the cowbird-blackbird as female; others the Brewer's as male and the cowbird female of a common species. The male cowbird is differentiated, terminologically, as *apíakssíkseini*, "lighter-colored *kseiní*." Hayden: *apiaksákseni*, brown blackbird. The term *kseiní* is echoic either of the harsh *chuck* or *check*, or the bubbly, squeeky song *kah-eee* or *klug-tseeee* (Peterson) of this group. Informants relate the term to *akseíni*, a word descriptive of the lowing of the bison. The element *-eini*, "bison," of *kseiní* represents an additional link, besides the symbiotic one,[12] between the cowbird and that animal.

Soyíkseini, "water *kseiní*," yellow-headed blackbird (*Xanthocephalus xanthocephalus* subsp.) and redwing (*Agelaius phoeniceus* subsp.). Hayden: *soyíksini*, water blackbird. Variants are *otaχkaúkaii*, "yellow breast" (UM), and *imaúkomini kseiní*, "red wing *kseiní*" (RS). The redwing is regarded as male and the yellow-headed blackbird as female of one species.

Inoxpínsoyi, "hanging nest," Bullock's oriole (*Icterus bullocki*). The species is known only to Sanderville and White Calf, and the former supplied the name.

Mikyótokan, "red head," western tanager (*Piranga ludoviciana*). Only Short Face and Green Grass Bull know the tanager, and the term is given by the former.

Pomisístsi, "grease bird," male goldfinch in summer plumage (*Spinus tristis*); *otaχkuitsístsi*,' "yellow bird," the female goldfinch and other small birds of yellow plumage. The former term is derived, according to informants, from the bird's color resemblance to the back fat of the bison.

Isikótokani, "black head"; *mototsistsi*, "spring bird," junco (*Junco* sp.). The last term refers to the early return of the junco in spring.

There is less interest, terminologically speaking, on the part of the Blackfeet in the smaller song birds than most any other avian group. Besides those diminutive species already discussed, the Indians select but few other varieties for specific designation. Instead the generic terms *póksistsi* and *kopútskseissi*, and the color designations *otaχkuítsistsi* and *ótskuisistsi*, are applied to the vireos, warblers, song sparrows, etc.

Atsinesístsi, "Gros Ventre bird," bobolink (*Dolichonyx oryzivorus*). The Blackfeet understand the bird's call as *atsiné*, their name for the Gros Ventre Indians. The latter are said to understand the bobolink's song. The song interpretation, "Spread your robe and I will alight upon it" is credited by my informants to the bobolink (RS) and summer longspurs (NG), and by McClintock to the chestnut-collared longspur (1910, p. 482) and horned lark (1923, p. 227).

Kopútsksissi, *kópsksissi*, "small nose," nuthatch (Sittidae), creeper (Certhiidae), and kinglet (Sylviidae). Variant terms for the gold-crowned and yellow-crowned kinglets are *imáχkini*, "red head," and *otaχkuíkini*, "yellow head," respectively.

Otsikékinaχsoatsis, "shoulder-bone tailfeathers," McCown's longspur (*Rhynchophanes mccowni*). Informants say that the name reflects comparison of the white portions of the species" tailfeathers to a bleached bone. This species is differentiated from the chestnut-collared longspur by its parachuting flight descent while in song. Assignment of the same term to the "snow bird" by UG (p. 195) demonstrates the native misconception that the respective summer and winter migrant longspurs are a common species residing continuously in the area throughout the year.

Isikaúkaii, "black breast," chestnut-collared longspur (*Calcarius ornatus*). This term may also represent a variant for the horned lark. McClintock (1910, p. 482), although first referring the name to the longspur, later assigns it to the lark. Hayden also gives "lark." There is considerable

[12] Taverner (pp. 376–377) notes that "in early times it [the cowbird] probably followed the buffalo, which suggested its old, nearly forgotten name of Buffalo-bird." In one of his popular novels, James W. Schultz (p. 129) has evoked memories of a faunal relationship, which must have been very familiar to the Blackfeet of an earlier period: "The fluttering and scolding of the buffalo-birds now warned us to be ready. These little creatures, a dusky variety of blackbird, lived constantly with the buffalo from early spring until winter drove them to a warmer clime. They were benefactors of the big, shaggy animals, perching upon their backs the greater part of the time and keeping them free from flies and other insect pests. They were angry now because the brush overhanging the trail kept sweeping them from their perches."

confusion in the minds of modern Blackfeet over the identities and names of the small winter migrants and related summer species.

Istutsistsi, "cold [winter] bird"; *apinákuisistsi*, "morning bird," snow bunting (*Plectrophenax nivalis nivalis*) and Alaska longspur (*Calcarius lapponicus alascensis*). Unaware also that the snow bunting migrated northward in spring, the Blackfeet attempt to equate it, after a seasonal change of plumage, with the chestnut-collared longspur.

Nipuaúeks, "arises early," domestic rooster; *nitauáke*, "lone woman," domestic hen. Hayden: *ōhúmi*, "bird that screams." *Omaxsápiksi*, "big *piksi*," domestic turkey. The first two terms are mimetic in character.

The Blackfeet assign the bat (Chiroptera) to the avian world and like the Gros Ventre (Kroeber, p. 281) consider its bite poisonous. The following names for the bat are given: *áukspiaki*, "clings to anything"; *matsiipítau*, "fine eagle"; *motínstami*, "many lodge poles"; *motsinípita*, "pretty labia." The last two designations are descriptive of the bat's appearance, the former referring to the cartilaginous wing ribs.

Analysis of the foregoing data provides some insight into the problem of how a preliterate people classify one segment of the multivaried phenomena of their external world. The Blackfeet have selected for naming some 80 odd species (in some cases, families) of the avian world and have built a total, including synonyms, of more than 100 different terms. In the few studies of this kind thus far made, Speck (p. 251) has recovered 75 bird names from the Penobscot of Maine and 70 from the Canadian Delaware; Witthoft (p. 373) writes of one North Carolina Cherokee's knowledge of 100 terms; while Gunther (pp. 105–118) has salvaged 45 from a Makah informant of Washington Coast.

For the Canadian Delaware the ratio of descriptive to mimetic terms is 2 to 1. In Blackfeet nomenclature, 90-odd terms are based upon factors of appearance-behavior and only 15 upon utterance, a ratio of 6 to 1. The preponderance of descriptive over echoic names in Blackfeet terminology may reflect a relatively recent development, since many of the archaic terms for plains-dwelling birds are apparently onomatopoeic in origin. During the present study, the writer observed that modern Blackfeet tend to denominate unfamiliar species in terms of color idiosyncrasies. So much for the quantitative aspects of Blackfeet nomenclature.

Blackfeet taxonomy, as revealed in the list of native bird names, is based not upon "essential identities of structure and development," as in modern ornithology, but largely upon gross and superficial similarities due to function. The inability of the Blackfeet to distinguish fundamental relationships in the realm of feathered wildlife is manifested at numerous points in their name system. The flight pattern of the tern, the aquatic habits of the avocet, the color of the bluebird led the Indians to classify them, respectively, with quite unrelated species. Terminological utilization of attributes of *form*, *habit*, and *utterance* coincides with the selection patterns of other ornithologically known tribes, and perhaps exhausts the possibilities of choice.

Another principle of Blackfeet taxonomy revealed in their terminology is the use of *omaχ*, "large," a prefix modifier in a number of bird names. The employment of this adjectival element is based upon the native belief, still enunciated today, in the existence of both a large and small variety of the same bird. Hayden's list shows marked evidence of this notion, apparently an old one in Blackfeet concept. I was unable to secure a rationalization of the belief, if such ever existed.

Native observation of bird life and habits, as reflected terminologically, is in some particulars acute, in others obtuse. An example of the latter is the crossing of species' lines in sex identification of the cowbird-blackbird group. Another is the failure to recognize migration as a factor in differentiation of the summer and winter larkspurs. Finally, it should be noted that the ideological screen of traditional meanings through which the Blackfeet view the birds, has also served to obscure certain basic relationships in the avian realm.

The question arises as to the relationship of Blackfeet nomenclature to the terminological systems of adjacent tribes in the Northwestern Plains. Lack of data prevents comparison not only with the linguistically related Plains Cree, Gros Ventre, and Chey-

enne but with other groups in this region. If we perforce turn to those more distant but ornithologically known Algonkians of the Eastern Woodlands, we find that correspondences are few and of a generalized nature. In Speck's Delaware-Penobscot material (p. 252), such apparent points of similarity occur as Wabanaki *si·ps, sisip*, etc., and Blackfeet *sistsí*, all generic terms for bird. Similarly, a comparison might be made of Blackfeet *pistó* and Canadian Delaware *pi·ckʷ*, Oklahoma Delaware *pick* and Penobscot (-Ojibway) *pesk* (Speck, p. 256), all designation for the nighthawk. However, since both sets of terms are probably onomatapoeic and since other eastern Algonkians have quite diverse forms, the evidence for genetic connections is slight.

It appears, then, that native faunal terminologies are no more stable than other preliterate conceptual systems under influence of culture change. In fact Witthoft (p. 372), in connection with his Cherokee study, has called attention to the possibility that in an acculturation situation, traditional knowledge in the field of natural history may be one of the first constellations to be destroyed. More specifically, Speck (p. 252) has pointed out the linguistic divergence set in motion only since the American Revolution between the Oklahoma Delaware and the Delaware in Canada in respect to their generic term for bird. In view of these findings, it is not surprising to find so little correspondence between the bird nomenclatures of the Blackfeet and their linguistic congeners in the east.

In summary, if the terminological elaboration in Blackfeet ornithology may be considered a rough index of that group's interest in the world of bird life, it is evident that their avian horizon is as wide as that of most other Indian tribes investigated. Insofar as popular imagination has pictured the Blackfeet as narrowly oriented toward and predominantly preoccupied with but one faunal species, the plains bison, to the same degree are such traditional notions subject to revision.

BIBLIOGRAPHY

CAMERON, E. S. *The birds of Custer and Dawson Counties, Montana*. Auk **24:** 241–270. 1907.

COUES, ELLIOTT (ed.). *New light on the early history of the Greater Northwest: The manuscript journals of Alexander Henry and of David Thompson*, 2 vols. New York, 1897.

EWERS, JOHN C. *The story of the Blackfeet*. Indian Life and Customs Pamphlet 6. U. S. Indian Service, Lawrence, Kans., 1944.

GUNTHER, ERNA. *A preliminary report on the zoological knowledge of the Makah*. Essays in Anthropology Presented to A. L. Kroeber. Berkeley, Calif., 1936.

HAYDEN, F. V. *Contributions to the ethnology and philology of the Indian tribes of the Missouri Valley*. Trans. Amer. Philos. Soc. **12:** art. 3. Philadelphia, 1863.

KROEBER, A. L. *Ethnology of the Gros Ventre*. Amer. Mus. Nat. Hist. Anthrop. Papers **1**. 1907.

MCCLINTOCK, WALTER. *The Old North Trail*. London, 1910.

———. *Old Indian trails*. Boston, 1923.

PETERSON, ROGER TORY. *A field guide to western birds*. Boston, 1941.

PEARSON, T. GILBERT (ed.). *Birds of America*. Garden City, N. Y., 1936.

SAUNDERS, ARETAS A. *A distributional list of the birds of Montana*. Pacific Coast Avifauna 14. 1921.

SCHULTZ, JAMES W. *The white beaver*. Boston, 1930.

SPECK, FRANK G. *Bird nomenclature and song interpretation of the Canadian Delaware: An essay in ethno-ornithology*. Journ. Washington Acad. Sci. **36:** 249–258. 1946.

TAVERNER, P. A. *Birds of Canada*. Nat. Mus. Canada Dept. Mines Bull. 72, Biol. Ser. 19. Ottawa, 1934.

UHLENBECK, C. C., and VAN GULIOK, R. H. *An English-Blackfeet Vocabulary*. Verh. Kon. Akad. Wetensch., Afd. Letterkunde, n. s., **29**(4). Amsterdam, 1930.

WISSLER, CLARK. *Ceremonial bundles of the Blackfeet Indians*. Amer. Mus. Nat. Hist. Anthrop. Papers 7, pt. 2. 1912.

WITTHOFT, JOHN. *Bird lore of the Eastern Cherokee*. Journ. Washington Acad. Sci. **36:** 372–384. 1946.

BOTANY.—*Five new Asteraceae from Mexico and South America.*[1] S. F. BLAKE, Bureau of Plant Industry, Soils, and Agricultural Engineering.

The new species here described have been found in various small collections sent for identification during the past few years.

Piqueria loxensis Blake & Steyermark, sp. nov.

Herbacea annua; caulibus erectis infra simplicibus 4.5–5 dm longis moderatim pubescentibus; internodiis plerumque 6–13 cm longis; foliis oppositis graciliter petiolatis, petiolis majusculis 14–18 mm longis, laminis ovato-triangularibus apice obtusis basi truncato-ampliatis integris ceterum margine grosse crenatis supra moderatim hirsutulis subtus praecipue in nervis hirsutulis et cum glandulis resinosis sessilibus ornatis, majoribus 3.5–4 cm longis 3.5–3.7 cm latis; capitulis 60–65-floris; phyllariis biseriatis 15 late spatulatis vel obovato-oblongis 2.2–3 mm longis 1.2–1.5 mm latis margine dense ciliatis; corollis 1.3–1.5 mm longis tubo dense pilosulo lobis ovatis papillatis; achaeniis 5-costatis glabris 1.1 mm longis.

Herbaceous annual; stems erect, simple below, loosely corymbosely branched above, subterete, 4.5–5 dm tall, moderately pubescent with mixed short and elongated (up to 1 mm) simple multicellular eglandular trichomes, lateral secondary branches 7–12 cm long; internodes 6–13 cm long; leaves opposite, petioles slender, 1.4–1.8 cm long on main cauline leaves, blade triangular-ovate, obtuse at apex, truncate-broadened at base subcuneately narrowed in the middle at junction with petiole, coarsely crenate above the base with 7–9 ovate-oblong obtuse to rounded teeth (the lower ones more prominent), membranaceous, triplinerved, moderately hirsutulous above, hirsutulous below especially on midrib and lateral nerves, with numerous sessile glands scattered over lower surface, largest leaves 3.5–4 cm. long, 3.5–3.7 cm wide in the lower half; inflorescence corymbosely cymose, of 5–9 heads in each cluster at the apex of the branches; heads 60–65-flowered; involucre broadly campanulate; phyllaries biseriate, subequal, 15, shorter than the florets, broadly spatulate to obovate-oblong, rounded at summit, narrowed below, somewhat 2-ribbed at base, 2.2–3 mm long, 1.2–1.5 mm wide, densely ciliate, especially in upper half, with 1–2-celled simple acuminate trichomes, faintly 3–5-nerved, the nerves not extending to and branching before reaching the margins; corollas 1.3–1.5 mm long, tube 0.3–0.5 mm long, densely pilosulous with subreflexed simple articulate trichomes, the throat and lobes together 1 mm long, lower part of throat sparsely beset with short glandular hairs, the broadly ovate lobes 0.3 mm long, subacute, sparsely papillose without; anthers delicately united by their margins, inappendiculate, 0.3–0.4 mm long; filaments slender, 0.5 mm long, glabrous; style branches exserted, subterete, 1.3 mm long, about the same width throughout, thickened at or near the tip; achenes 5-costate, 1.1 mm long, blackish; pappus a low crown; podium well-developed.

ECUADOR: Prov. Loja, Cerro Pucará, alt. 2,300 meters, May 18, 1946, *Reinaldo Espinosa 405* (TYPE, in Herb. Chicago Nat. Hist. Mus., isotypes in N. Y. Bot. Gard. Herb. and U. S. Nat. Arboretum).

This species differs from *P. sodiroi* Hieron., to which it is closely related, by having 15 instead of 10–12 phyllaries, which are somewhat broader in the upper half; the corolla throat sparsely covered with short minute gland-tipped hairs, whereas in *P. sodiroi* the glands are large and conspicuous, the hairs of the corolla lobes short, whereas in *P. sodiroi* they are much more numerous and more elongated; the heads somewhat larger, with more numerous florets; the leaves larger, with shorter trichomes on lower surface of blades and longer petioles; the stems erect and single instead of procumbent and several, with longer internodes and fewer and more remote leaves; and the phyllaries more uniformly ciliate and more conspicuously 2-ribbed at base.

Aplopappus pseudobaccharis Blake, sp. nov.

Frutex scoparius metralis glaberrimus modice resinosus, ramis et ramulis multis erectis pallide viridibus striato-angulatis; folia anguste linearia integerrima plana paullum incrassata omnino non vel solum supra obscurissime punctata usque ad 1.4 cm longa 1 mm lata; capitula parva radiata 12–15-flora aurea pseudoracemosa 5–15 per ramum, pedunculis 1-cephalis inferioribus bracteatis usque ad 3 cm longis superioribus 1–2 mm longis vel subnullis; involucri ca. 3.5 mm alti turbinati gradati 4–5-seriati phyllaria oblonga obtusa v. acutiuscula chartacea apice viridescen-

[1] Received August 22, 1949.

tia margine scariosa; radii 4–6 parvi, lamina ca. 2 mm longa; achenia dense et appresse sericea.

Broomlike shrub, 1 m high; stem slender, in age whitish-barked; branches and branchlets about 5-angled, 1 mm thick or less; internodes mostly 5–10 mm long; leaves wanting except on branches of the year, without axillary fascicles, erectish, obtuse or sometimes subacutely callous-pointed, pale green, the midrib beneath marked by a glandular vitta, the branch leaves smaller, mostly 3–8 mm long; heads (moistened) 6 mm high (excluding styles), about 4.5 mm wide; phyllaries oblong or oblong-ovate, obtuse or the outer acutish, glabrous but often obscurely subglandular-denticulate at apex, scarious-margined except toward apex, the single glandular vitta slightly enlarged toward tip into an inconspicuous linear gland, the outermost phyllaries about 2 mm long, 0.9 mm wide, the middle and inner about 3 mm long, 1–1.3 mm wide; receptacle irregularly fimbrillate-setiferous, the fimbrillae or setae up to 0.5 mm long; rays 4–6, the lamina elliptic, spreading, 2–3-denticulate or 2-dentate, 3–4-nerved, 2–2.3 mm long, 1–1.3 mm wide, the tube 1–1.3 mm long, sparsely short-hairy above; disk flowers 8–9, their corollas rather slenderly obconic, sparsely puberulous on tube above, unequally 5-cleft, 4.3 mm long (tube 1 mm, throat 1 mm, one tooth 2.3 mm, the others 1.3 mm long); achenes oblong, 6–7-ribbed, 1.3 mm long, densely short-silky, the prolongation of the upper hairs beyond the achene simulating an outer pappus; pappus 3.5 mm long, of 24–28 subequal minutely hispidulous stramineous bristles; style appendages (disk flowers) lanceolate, obtuse, 1 mm long, equaling the stigmatiferous lines.

MEXICO: Large colony on arid limestone hillside, Valle Seco, Sierra Paila, General Cepeda, Coahuila, 1,700 m, July 4, 1944, *James C. Hinton* (G. B. Hinton et al. 16546) (TYPE, no. 1890353, U. S. Nat. Herb.).

The essentially complete absence of impressed glands in the leaves of this plant places it technically in Hall's section *Asiris*, which contains no closely similar species. Its closest natural relationship is clearly with *A. palmeri* Gray of the sect. *Ericameria*, but in that species of southern California and Baja California the branches are terete or subterete and very leafy, the leaves are longer, always densely punctate, and normally provided with axillary fascicles, and the involucre is longer.

Diplostephium abietinum Blake, sp. nov.

Frutex humilis; rami compacte ochraceo-tomentosi dense foliosi demum defoliati cicatricosi; folia linearia patentia crassiuscula ca. 8 mm longa 1 mm lata apice obtuse callosa sessilia margine revoluta supra valde resinosa juventate paullum pilosula subtus ochraceo-cinereo-tomentosa; capitula solitaria majuscula subsessilia radiata; involucri 10–11 mm alti ca. 6-seriati valde gradati phyllaria lanceolata acuminata piloso-cilata et praecipue exteriora dorso laxe cinereo-pilosa; achenia dense hirsutula.

"Low growing shrub"; upper part of stem (terete, 2.5 mm thick) and branches closely and not very thickly ochraceous- or in age cinereous-tomentose, densely covered with the imbricated bases of fallen leaves, these deltoid, obtuse, about 1.5 mm high and wide, decidedly wider than the leaf blades; branches subverticillate, 3–4 cm long, erectish; leaves above grayish green, resin-coated but dull, when young thinly cinereous-pilosulous but soon glabrate, not spinulose or glandular, beneath densely ochraceous- or in age cinereous-tomentose, 1-nerved, the margins revolute to the edge of the midrib beneath, the midrib strong, rounded and somewhat elevated above (the leaf thus sulcate on each side of midrib), concealed by the tomentum beneath, the apex of leaf brownish, denudate, obtusely callous-tipped; heads solitary at tips of branches, 1.6–2 cm wide (as pressed), sessile or on a peduncle 2 mm long; phyllaries chartaceous, whitish, rather strongly 1-nerved, about 1.5 mm wide; rays about 21, of unknown color, the tube 1.5 mm long, sparsely puberulous toward apex, the lamina linear-elliptic, 3-denticulate, 4-nerved, 8.5 mm long, 1.7 mm wide; disk flowers numerous, their corollas sparsely pilosulous toward base of throat, 5.3 mm long (tube 1.8 mm, throat slenderly funnelform, 2.8 mm, teeth spreading, 0.7 mm long); achenes of ray obovoid, somewhat compressed, 5-nerved, about 2 mm long, rather densely erect-hirsutulous, not glandular, their pappus of about 20 hispidulous bristles 5.5–6.5 mm long and an outer series of setiform squamellae 0.7–1 mm long; achenes of disk similar, 2.5 mm long, the bristles about 25, 5 mm long, the outer pappus of setiform squamellae 1–1.2 mm long; pappus purplish; style branches of disk flowers linear, acuminate, dorsally hispidulous, 1.6 mm long.

PERU: In full exposure, Piscohuañuno Pass, near Rioja, Dept. Amazonas (?), 3,050 m, August

1938, *Christopher Sandeman* 13 (TYPE, Herb. Kew; photograph and fragment, U. S. Nat. Herb.).

This plant is a member of the group in the series Lavandulifolia having leaves not impressed-glandular above and a large involucre. It is distinguished from others of this group by having short, linear leaves, resinous-coated but scarcely if at all tomentose on the upper surface, and not spinulose. The species is described from a single stem-apex 15 cm long.

It is uncertain whether the type locality is in the Department of San Martín or Amazonas. Rioja is shown on the American Geographical Society's 1938 map (Loreto sheet) as in San Martín, about 20 km west of Moyobamba; the Cerros de Piscohuañuno as nearly 40 km farther west, in the Department of Amazonas. On the basis of the altitude given, the Pass is presumably in Amazonas, in the Province of Chachapoyas.

Montanoa gentryi Blake, sp. nov.

Arbor gracilis; rami subteretes glabri; folia superiora ovata acuminata basi cuneata crenato-serrata non lobata 3-plinervia supra lepidoto-hispidula scabra aetate laevia et lucida subtus subdense griseo-pilosula pilis incurvatis et glanduloso-adspersa, lamina ca. 6 cm longa 2.5 cm lata, petiolo ca. 8 mm longo; capitula parva 4–5-flora discoidea vel saepius radio unico praedita breviter pedicellata dense cymoso-paniculata; paleae dense pilosae, apice patente pungente.

"Slender tree with fissured trunk and dark heart wood"; branches of the year brownish white, slender, 1.5–2 mm thick, the internodes 5–25 mm long, the older branches grayish; leaves opposite; petioles densely pilosulous with ascending hairs, glabrescent, 5–10 mm long; blades gray-green, firm-papery, triplinerved about 8 mm above the cuneate unappendaged base and with 2 pairs of weaker nerves below the main nerves, somewhat bullate above in age, 5.5–6.5 cm long, 1.5–3 cm wide; panicles terminal, flattish or somewhat rounded, 8–10 cm wide, very many-headed, densely pilosulous with ascending to spreading hairs, the lower bracts leaflike, small, lanceolate, 1.8–4 cm long including petiole, the upper minute and squamiform, the pedicels mostly 2–4 mm long, densely spreading-pilose; disk (moistened) 7–8 mm high (including corollas), about 3–4.5 mm thick; involucre 1–2-seriate, the phyllaries 5–9, ovate, acute to acuminate, apiculate or cuspidate, densely pilose, 3–5-nerved, 1.3–2.8 mm long, 0.7–1.5 mm wide; ray when present neutral, white, stipitate-glandular on tube and back, the tube 1–1.3 mm long, the lamina oval or oblong-oval, 5–6-nerved, 3-dentate, 2.7–4.5 mm long, 1.5–2 mm wide; disk corollas 3–5, white, hirsutulous on tube, upper part of throat, and teeth, 3.5–4.2 mm long (tube 1.3 mm, throat 1.6–2 mm, teeth 0.7–1 mm long); fruiting pales firm, 5 mm long, densely long-pilose, the straight triangular-subulate stiff tip about 1.5 mm long, spreading at an angle of about 45°; achene obovoid, plump, blackish, 2.5 mm long, epappose.

MEXICO: Rocky canyon rim, short-tree forest, Capadero, Sierra Tacuichamona, Sinaloa, alt. 1,065 m (3,500 feet), February 13, 1940, *H. S. Gentry* 5614 (TYPE, no. 161373, herb. U. S. Nat. Arboretum).

The heads of this species have usually 1 ray and 3 disk flowers, but sometimes 4 or 5 disk flowers and no rays. It is a member of the section *Eriocarpha*, probably nearest *M. seleri* Robins. & Greenm. of Chiapas. In that species the heads have more flowers and the phyllaries are much less pubescent, in fact definitely green in anthesis. It is also related to *M. microcephala* Sch. Bip., which is still known only from the type collection made by Liebmann (no. 483) at Ejutla, Oaxaca. In this the petioles are narrowly margined to base, the ray flowers are 3, and the disk flowers 12 (fragments of type examined in U. S. National Herbarium).

In its about 4-flowered, sometimes discoid heads *M. gentryi* suggests *M. anomala* Robins. & Greenm. (*M. hemsleyana* (Kuntze) Blake, based on a hyponym) and *M. rekoi* Blake. In the former the leaf blades are as broad as long and densely rusty-pubescent beneath; in the latter, a stout tree of Oaxaca with a trunk up to 0.5 m thick, the leaves are similar in shape to those of *M. gentryi* but are soon glabrate beneath. *M. rosei* Robins. & Greenm., which is similar in foliage to *M. gentryi*, has much larger phyllaries (5–6 mm long in anthesis) and more numerously flowered heads.

Flourensia solitaria Blake, sp. nov.

Frutex parvus ramosus paullum glutinosus, ramis erectis monocephalis, caule dense hirtello; folia parva oblanceolata v. majora obovata subsessilia integerrima acuminata disperse hispidula penninervia v. obscure triplinervia; capitula discoidea mediocria solitaria ca. 30-flora longiuscule

pedunculata erecta; involucri ca. 5-seriati gradati 10 mm alti phyllaria extima lanceolata acuminata interiora oblongo-obovata acuta v. acuminata, omnia basi indurata apice herbacea appressa v. extima parum laxa; achenia valde costata subglabra, pappo nullo.

Bush 0.3–0.6 m high, with numerous erectish branches, resinous-scented; stem with grayish-brown fissured bark, densely hirtellous with very short thick white hairs, more or less glabrate; branches normally simple, very slender, brown, striate-angulate, pubescent like the stem but only sparsely and irregularly so, often nearly glabrous above; internodes mostly 6–10 mm long on lower part of branches, 1.8–3.5 cm long above; leaves oblanceolate or the larger obovate, often with fascicles or short branchlets in their axils, 1.8–3.3 cm long, 3–10 mm wide, coriaceous, slightly resinous, plane, light green both sides, inconspicuously pubescent like the stem, narrowed into a petioliform margined base, loosely somewhat impressed-reticulate, subulately callous-tipped; peduncles slender, 3–5 cm long, naked or 1-bracteate, not thickened below the head; disk campanulate or campanulate-hemispheric, 12–13 mm high, 8–13 mm thick (as pressed); outermost phyllaries lanceolate, 4.5–6 mm long, about 1.5 mm wide, acuminate, sparsely and obscurely hirtellous, with short pale indurated base and much longer appressed or loosely erectish herbaceous tip, the middle ones oblong or lance-oblong, about 2.5 mm wide, ciliolate, many-vittate, the inmost oöovate-oblong, acute, with short herbaceous tip; pales rather narrowly cuneate-spatulate when flattened out, acute or obtuse, apiculate, 10–11.5 mm long, slightly hirsutulous on back and obscurely ciliolate at tip, about 5-vittate, subscarious with greenish tip; disk corollas golden-yellow, resinous-granular on the teeth, 7.5–8.3 mm long (tube 1.5–1.8 mm, throat subcylindric, 5–5.5 mm, teeth ovate, obtusish, 1 mm long); achenes obovoid, plump, strongly 5–6-ribbed and with 1 or 2 usually weaker ribs between each pair of strong ribs, resinous, obscurely puberulous between the ribs above, not ciliate, epappose, 4.8–5.5 mm long, 2–2.5 mm wide.

MEXICO: Rocky flats and slopes, top of grade at Cuesta de Zozaya (along road from Ocampo west over the mountains to Puertecito via Cuesta de Zozaya), Coahuila, September 20, 1941, *I. M. Johnston* 9289 (TYPE, Gray Herb.; photograph and fragment, herb. U. S. Nat. Arboretum).

Nearest *Flourensia cernua* DC. but very distinct in its narrower, mostly oblanceolate leaves, its larger erect heads solitary at the tips of the branches, and its obovoid, strongly ribbed, subglabrous, epappose achenes.

MYCOLOGY.—*Some Cuban Phycomycetes.*[1] F. K. SPARROW,[2] University of Michigan.

When we consider the luxuriance and diversity of the phanerogamic flora of the Tropics, it is not surprising to find as our knowledge of the soil microflora of this region is increased that here, too, is a rich area awaiting intensive study. The fungi herein described were obtained from the provinces of Las Villas (Santa Clara) and Matanzas in central Cuba. With one exception they were all collected by the author from extremely dry soil during a prolonged period of drought. In addition to these fungi a number of other already described species were found. These will be discussed in another, more extensive paper. The methods of isolation employed are similar to those used by other workers in this field (Couch, 1939, et al.) and need not be repeated here.

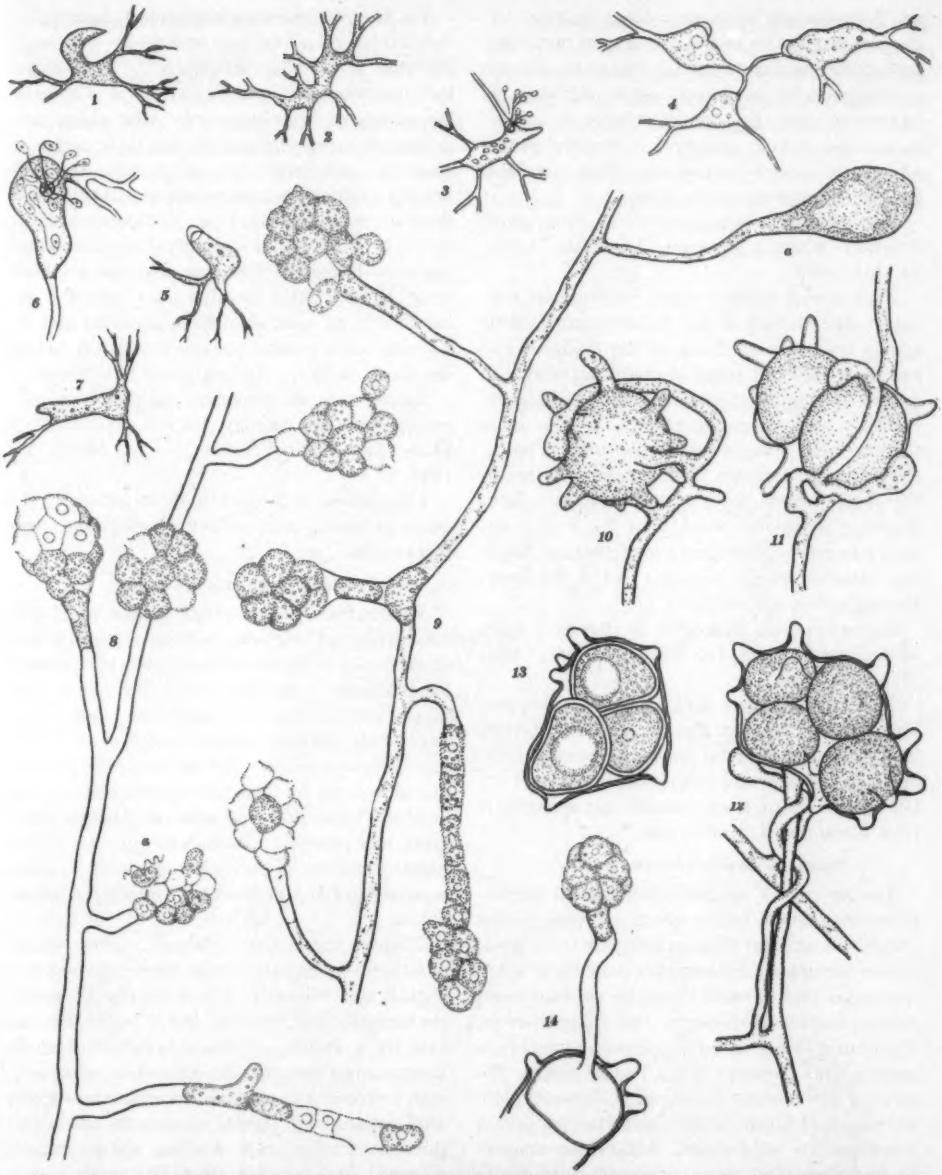
Phlyctorhiza peltata, sp. nov.

Thallus unicentricus, raro multicentricus, superficialis in exuviis anguis, et ceteris; rhizoideis varie ex thallo orientibus, diametro 3μ (vel minus) ad originem, sursum angustatis et modice ramo-

[1] Publication no. 5, Journal Series from the Atkins Garden and Research Laboratory of Harvard University, Soledad, Cienfuegos, Cuba, and Contribution no. 899 from the Botany Department, University of Michigan. Acknowledgment is made to the executive board of the Horace H. Rackham School of Graduate Studies for a grant from the Faculty Research Fund, which made these studies possible. Received August 22, 1949.

Slides of the new forms are in the writer's collections.

[2] It is a pleasure to acknowledge with thanks the many courtesies extended to the writer by the Atkins family, especially Mrs. E. F. Atkins, and by Dr. A. G. Kevorkian, lately director of the Atkins Gardens and Research Laboratory.



FIGS. 1–14.—1, 2, Monocentric thalli of *Phylctorhiza peltata*, sp. nov.; 3, discharging sporangium of same; 4, polycentric thallus of *P. peltata*; 5, nearly mature sporangium showing discharge papilla; 6, discharging sporangium at higher magnification (× 650); 7, thallus of *P. peltata*. 8–14, *Aphanodictyon papillatum* Huneycutt: 8, portion of thallus bearing zoosporangia (a, zoospores in process of leaving cysts); 9, portion of thallus bearing sporangia of different shapes (*a*, one in process of formation); 10, young oogonium with encircling androgynous antheridial branches; 11, more mature sexual apparatus, the oogonium bearing two eggs; 12, oogonium with one androgynous and one diclinous antheridium; 13, old oogonium bearing mature oospores; 14, germinated oospore with germ tube bearing a single sporangium. (Figs. 1–3, 5, 7, × 330; Figs. 4, 6, 8–14, × 650.)

sis. Zoosporangia irregularia, longe peltata, 15–28μ longitudinaliter et 5–8μ transverse metientia, maturitate papillam singulam formantia demum a deliquescentia in porum sessile diametro 5μ transformantem. Zoosporae ovoideae 4μ longae, 2μ crassae, globulo refractivo et flagello postico ad apicem corporis angustiorem affixo praeditae. Sporae durantes non observatae.

Saprophytum in anguis exuviis ex rivulo prope Sanctam Claram in provincia "Las Villas," Cuba, 24 Mar., 1949.

Thallus monocentric, rarely polycentric, resting on the surface of the substratum; rhizoids arising from several places on the thallus, 3μ or less in diameter at point of origin, tapering and moderately branched distally. Zoosporangia irregularly and elongately peltate, 15–28μ along the long axis, 5–12μ along the shortest; at maturity forming a single papilla, which at maturity deliquesces to form a sessile exit pore 5μ in diameter. Zoospores ovoid, 4 by 2μ, with a minute refractive droplet and a long posterior flagellum attached to the narrower end of the body. Resting spores not observed.

Saprophytic on snakeskin in stream 5 miles west of Santa Clara, Las Villas Province, Cuba; March 24, 1949.

The species differs strikingly from *Phlyctorhiza endogena* Hanson and *P. variabilis* Karling in the peltate, irregular (never spherical) shape of the sporangium and sessile exit pore (Figs. 1–7). Other, less conspicuous features also separate it from the aforementioned forms.

Nowakowskiella atkinsii, sp. nov.

Thallus patens, multiramosus paucas tumiditates irregulares ferens etiamque raro partes (functionis ignotae) magnas setigeras 1- vel 2-cellulares turbinatas. Sporangia terminalia in apicibus ramis plus minusve elongatis vel raro intercalaria, saepissime sphaerica, raro subpyriformia, diametro 13–20μ, saepe apophysata; membrana paucas setas flexuosas 9–16μ longas ferente. Zoosporae subovoideae 5μ longae, 3μ crassae, globulo singulo et flagello postico praeditae, per porum lateralem vel subbasalem dehiscentia operculi 8μ diametientis emergentes, primum ante motilitatem exhibentes campacte aggregatae. Sporae durantes ignotae.

Saprophytum in substantis artificiali cellophanum dicta ex solo saxigeno in planitiebus sterilibus serpentinis prope Sanctam Claram, in provincia "Las Villas," Cuba, 24 Mar., 1949.

Thallus extensive, much branched, bearing occasional irregular swellings and rarely very large (35–40μ × 18–25μ) setigerous 1- or 2-celled turbinate organs. Sporangia at the tips of more or less elongated branches, rarely intercalary, predominantly spherical and 13–20μ in diameter or somewhat pyriform, often apophysate; the wall bearing a variable number of somewhat thickened flexuous setae, 9–16μ long. Zoospores slightly ovoid, 5 by 3μ with a single hyaline globule and posterior flagellum; emerging through a lateral or subbasal slightly elevated pore upon the dehiscence of an operculum 8μ in diameter and remaining in a compact quiescent group before assuming motility. Resting spore not observed.

Saprophytic on cellophane, in soil from serpentine savanna country 2 miles west of Santa Clara, Las Villas Province, Cuba, March 24, 1949.

This species is distinct from all others of the genus in having setae on the sporangia and turbinate cells (Figs. 25, 26).

Blastocladiopsis, gen. nov.

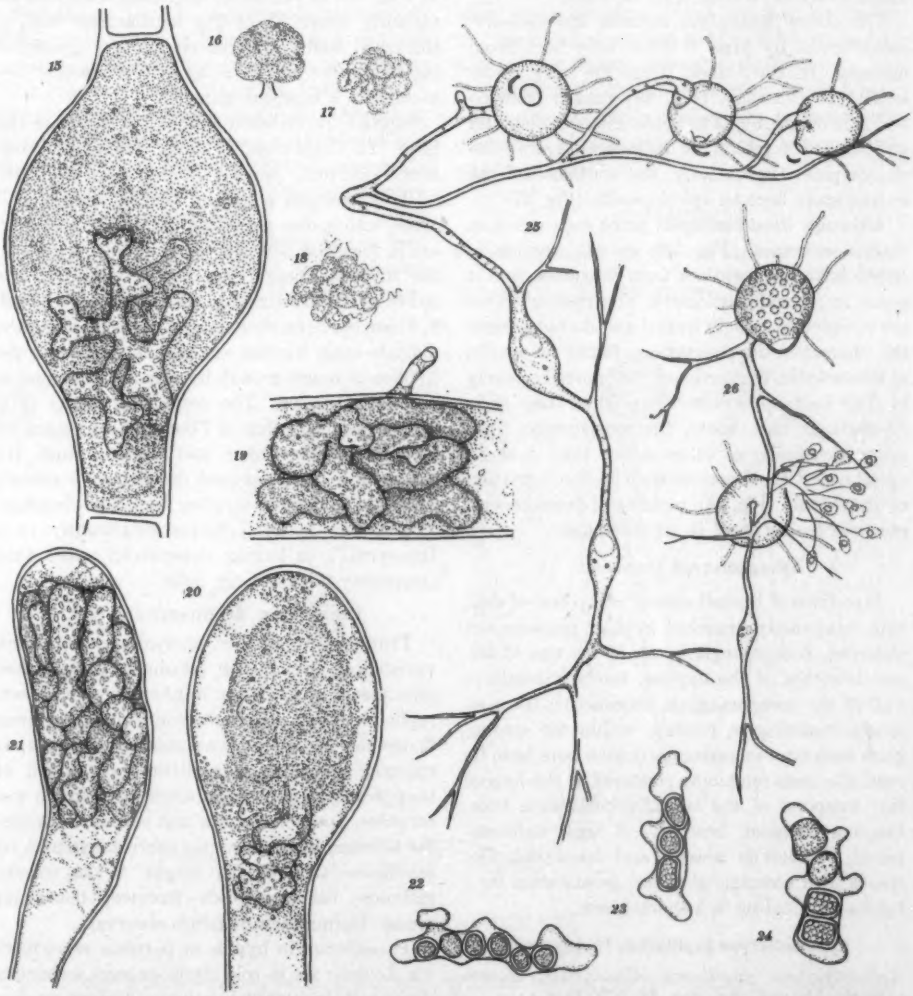
Thallus filamentosus absque cellula basali definita, usque ad originem partium sexualium non septatus, ad substrato adfixus a rhizoideis crassis. Zoosporangia irregularia vel subcylindrica; papillis emittientibus 1–6. Zoosporae postice uniflagellatae, globulis oleiferis pluribus et nucleo galericulato praeditae. Sporae durantes plerumque globulares vel interdum subellipsoidales, singulatim et mobiliter contentae, membrana aurea, laevi, non punctata circumdatae, demum germinatione fractae et zoosporas per poros paucos postice flagellatas emittientes. Gametophyton ignotum.

Thallus filamentous, without a well-defined basal cell; nonseptate except where reproductive organs are delimited; dichotomously or subdichotomously branched; anchored to the substratum by a system of coarse-branched rhizoids. Zoosporangia irregular or somewhat cylindrical, with 1–6 discharge papillae. Zoospores posteriorly uniflagellate, with several oil globules and a conspicuous nuclear cap. Resting spores usually spherical or somewhat ellipsoidal, with a thin, golden to amber-colored smooth, nonpunctate wall; borne singly and loosely within their container; upon germination cracking open and discharging posteriorly uniflagellate zoospores through one or more pores. Gametophyte unknown.

Blastocladiopsis parva (Whiffen), comb. nov.

Blastocladia parva Whiffen, Journ. Elisha Mitchell Sci. Soc. **59**: 40. 1943.

Thallus 300μ or more in length, unbranched or more commonly dichotomously or subdichomously branched; hyphae 12–50μ in diameter, somewhat irregular. Zoosporangia rare, terminal on the hyphae, irregular or somewhat cylindrical, 40 by 65.6 to 41.3 by 90.2μ, with 1–6 discharge papillae. Resting spores lying loosely in a smooth-walled or occasionally apically papillate container, spherical, ellipsoidal or ovoid, 36.8 by 41μ to 35.2 by 77.1μ, with a pale amber colored smooth, non-punctate wall; upon germination the wall cracking open and posteriorly uniflagel-



FIGS. 15–26.—15–24, *Lagenidium destruens*, sp. nov.: 15, Young thallus in hypertrophied, walled-off part of *Achlya* hypha; 16–18, stages in formation of zoospores at mouth of discharge tube; 19, mature sporangium with discharge tube penetrating wall of host hypha; 20, 21, thalli in hyphae of host; 22–24, small thalli bearing resting spores. 25, 26, *Nowakowskiella atkinsii*, sp. nov.: 25, Thallus bearing three discharged sporangia; 26, portion of thallus bearing a mature sporangium and one discharging its zoospores. (Figs. 15, 30, 21, × 225; Figs. 16–24, ×330; Figs. 25, 26, × 650.)

late zoospores escaping through one or two discharge pores.

Saprophytic on snakeskin used as bait, in soil from a tomato field, 3 miles east of Santo Domingo; grass leaves used as bait, in soil from rocky field, 4.5 miles east of Santo Domingo; snakeskin bait, in soil from edge of canefield 7.8 miles north of Cienfuegos on Palmira road; Las Villas Province, Cuba, April 15, 1949.

The above description includes the measurements given by Miss Whiffen from her Texan material. In the Cuban fungi the very rarely formed zoosporangia (Fig. 30) ranged from 55 to 70μ in length by 22 to 25μ in greatest diameter and formed a lateral as well as an apical discharge pore. Occasionally, the container of the resting spore bore an apical papilla (Fig. 27).

Although *Blastocladiopsis parva* approaches in thallus structure (Fig. 29) certain species of *Blastocladia*, it is distinct from members of that genus in several particulars. The resting spores are completely smooth walled and do not possess the characteristic punctations found in species of *Blastocladia*. Furthermore, the spores lie loosely in their containers rather than filling them as in *Blastocladia*, and, lastly, the zoosporangia form up to six discharge tubes rather than a single apical one. Other features such as the formation of dwarf thalli (Fig. 28), rapidity of development, etc., will be discussed in another paper.

Aphanodictyon Huneycutt

Mycelium of limited extent, composed of delicate, moderately branched hyphae; gemmae not observed. Zoosporangia borne at the tips of lateral branches of the hyphae, rarely intercalary; wall of the zoosporangium evanescent; the zoospores encysting in position within the sporangium each later emerging through a pore from its cyst, the cysts remaining clustered at the hyphal tip; zoospores of the laterally biflagellate type. Oogonia terminal, bearing 3–5 eggs; walls unpitted. Antheridia present and functional. Oospores with eccentric globules; germinating by a hypha terminating in a sporangium.

Aphanodictyon papillatum Huneycutt

Aphanodictyon papillatum Huneycutt, Journ. Elisha Mitchell Sci. Soc. **64**: 279, 1948.

Mycelium delicate; hyphae sparingly branched, the main components about 5μ in diameter. Zoosporangia clavate, occasionally nearly cylindrical, terminal on lateral branches along the hypha, rarely intercalary, 13–70μ long by 12–18μ in greatest diameter, forming a false net after emergence of the zoospores; the zoospores reniform, 6–9μ by 4–7μ, with granular contents. Oogonia at first spherical, becoming irregular in shape at maturity; bearing numerous broad papillae; wall unpitted; bearing 3–5 somewhat spherical eggs 18–25μ in greatest diameter. Antheridia androgynous or occasionally diclinous as well, one or two on an oogonium. Oospores irregularly spherical 18–25μ in diameter with a thickened wall and eccentric globule; germinating soon after formation by a hypha which terminates in a zoosporangium.

Saprophytic on snake skin bait in soil from the finca "La Esperanza," Palmas, Matanzas Province, Cuba (coll. Angel Valiente), April 17, 1949.

Aphanodictyon is distinct from all Saprolegniaceae with spores encysting within the sporangium in the great delicacy of its vegetative growth, the mycelial mass being barely visible to the naked eye. Furthermore, the zoosporangia (Figs. 8, 9) are borne on short lateral branches along the delicate main hyphae and do not terminate the hyphae or renew growth by cymose branching as in related genera. The sexual apparatus (Fig. 10–14) resembles that of *Thraustotheca*, especially *T. primoachlya* Coker and Couch. Since the species has been reported only once, it seemed desirable to include a rather complete diagnosis. The Cuban material differs significantly from Huneycutt's in having moderately rather than excessively thick oospore walls.

Lagenidium destruens, sp. nov.

Thallus irregulariter dactylomorphus ramis variabilibus brevibus in plexum contortis interdum plenas partes hospitis infectas valde hypertrophas implens, sporangium unicum proveniens. Zoosporae numerosae reniformes, 12μ longae, 8μ crassae, lateraliter biflagellatae per tubam ex hospite extrusae ut massa amorpha, demum maturantes. Sporae durantes non sexualiter derivatae seriatim in thalli ramis, subrectangulares vel subellipsoidales, 10–15μ longae, 8–12μ crassae, globulos olei numerosos ferentes; membrana crassa. Germination nondum observata.

Parasiticum in hyphis et partibus reproductivis Achlyae sp. in solo sterili ex saxo serpentino derivatum in planitiebus prope portum navium aeriarum oppidi Sanctae Clarae, in provincia "Las Villas," Cuba, 24 Mar., 1949.

Thallus consisting of a complex of short, finger-like irregular and contorted branches of variable size which may fill the strongly hypertrophied

host parts; forming a single zoosporangium. Zoospores variable in number, reniform, 12 by 8μ, laterally biflagellate, ejected in an amorphous mass from the discharge tube to the outside of the host where maturation is completed. Resting spores asexually formed in a series in branches of the thallus, rectangular or somewhat ellipsoidal, 10–15 by 8–12μ, bearing numerous oil globules; wall thickened; germination not observed.

Parasitic in hyphae and reproductive organs of *Achlya* sp., in soil from serpentine savanna country just west of the Santa Clara airport, Las Villas Province, Cuba, March 24, 1949.

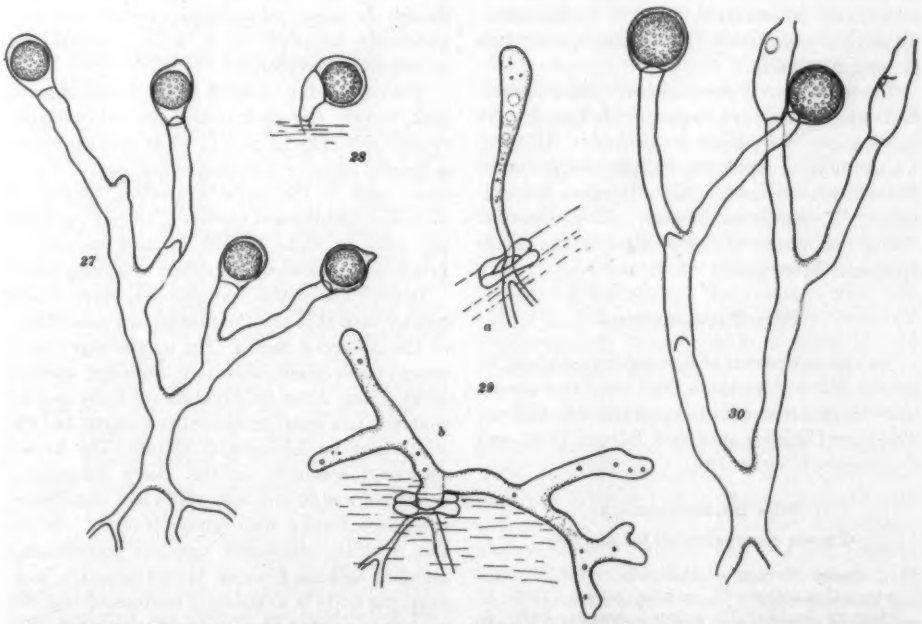
This species is remarkable for its virulence as a parasite. All parts of the host were invaded and destroyed within a few days. Both zoosporangia (Fig. 19) and resting spores (Figs. 22–24) were formed almost simultaneously.

In early stages of thallus development pronounced hypertrophy of the host is evident even though the parasite itself may be wholly or partially masked by the dense contents of the infected part (Figs. 15, 20, 21). Cross walls may or may not be laid down by the host to wall off infected areas. Thalli converted into zoosporangia discharge their contents through a short tube to the outside where the mass, apparently without an enveloping vesicle, rapidly becomes converted into biflagellate zoospores (Figs. 16–18). Other thalli by cleavage of their protoplasm into uniform sized irregular blocks produce asexually the thick-walled resting spores which undoubtedly survive during periods of drought.

L. destruens differs from all other 1-celled, saccate species of the genus in the extraordinary complexity of thallus development, resting spores and fungus host.

REFERENCE

COUCH, JOHN N. *Technic for collection, isolation, and culture of chytrids.* Journ. Elisha Mitchell Sci. Soc. **55**: 208–214. 1939.



FIGS. 27–30.—*Blastocladiopsis parva*, comb. nov.: 27, Plant bearing papillate resting spore containers (note suppressed branches); 28, dwarf plant consisting of a few rhizoids in substratum a short basal cell and single resting spore; 29*a*, young plant emerging through stoma of grass substratum; 29*b*, older plant; 30, thallus bearing two resting spores and two cylindrical sporangia, each with two discharge pores. (All × 225.)

ZOOLOGY.—*Nemerteans from Antarctica and the Antarctic Ocean.*[1]

WESLEY R. COE, Scripps Institution of Oceanography. (Communicated by F. A. CHACE, Jr.)

The collections of the United States Navy Antarctic Expedition in 1947–48 contained 75 specimens of nemerteans. These were dredged at several stations or collected along the shore of one of the islands in Marguerite Bay, Antarctica, near Peter I Island, Ross Island, and Cape Ross, by F. C. Nutt. Marguerite Bay is between Alexander I Island and Adelaide Island (68°–69°S., 68°–70°W.). It has a depth of 70 to 80 meters at the stations where the nemerteans were dredged. The collections indicate that the bay has a rather abundant nemertean fauna in spite of a water temperature of −1°C. or lower.

Although the collection includes only those species that have been previously described from the Antarctic region, the known geographical range is hereby extended and additional information relative to the morphological characteristics of the species has become available.

The species represented have been identified as: *Lineus corrugatus* McIntosh, 54 specimens; *Amphiporus gerlachei* Bürger, 1 specimen; *A. spinosus* Bürger, 1 specimen; *Tetrastemma amphiporoides* Bürger, 7 specimens; *T. validum* Bürger, 12 specimens. These specimens are deposited in the U. S. National Museum.

Order PALEONEMERTEA

No representatives of this order were obtained by the Navy Expedition, and only two species have been reported from Antarctic regions. These are *Carinina antarctica* Bürger, 1904, and *C. mawsoni* Wheeler, 1940.

Order HETERONEMERTEA

Lineus corrugatus McIntosh, 1887

Cerebratulus corrugatus Hubrecht, 1887; *C. steinini, C. subtilis, C. validus* Bürger, 1893; *C. charcoti* Joubin; *C. autrani* Joubin, 1908; *L. corrugatus* Baylis, 1915; *L. corrugatus* Wheeler, 1934, 1940.

This species is so highly variable both in form and color that it is not surprising that the varieties were formerly considered to represent separate species. The worms are capable of an unusual degree of extension and contraction in life and on being placed in preserving fluid contract into a great variety of shapes. Consequently shape of head and length of cephalic grooves, as well as position and size of mouth, offer little evidence as to their specific identity. As a result, several different names have been given to the preserved specimens in the different collections. The species has usually been placed in the genus *Cerebratulus*, but the study of many living individuals by Wheeler (1934) proves that they have the essential characteristics of *Lineus*.

Colored figures of the living worms published by Wheeler show that the body is smooth and moderately flattened and elongated in life, although the preserved specimens are often so conspicuously wrinkled as to have justified the species name *corrugatus*.

The color in life varies in many shades of gray, pink, brown, and dark reddish brown or black; ventral side paler. A pair of white vertical bands is usually more or less conspicuous near the posterior ends of the cephalic grooves. Region of proboscis opening and borders of cephalic grooves pale gray or white. Similar in most respects to *Lineus magelhaensicus* but differs in lacking ocelli.

Individuals of this species often reach a size greater than that of any other known nemerteans of the Antarctic region. The length may sometimes exceed 50 cm. when fully extended, and the width 3 mm. After preservation the body usually contracts to a small fraction of this length, but the width may be increased to 15 mm. The largest preserved specimen in the Navy Expedition collection was 90 mm long and 8 mm wide. Some specimens remain with relatively little contraction, with smooth bodies, narrowly pointed head and long cephalic grooves. More frequently, however, the body is so strongly contracted that the surface is roughly furrowed and corrugated, with the head withdrawn and the cephalic grooves correspondingly short.

Geographical distribution: This is evidently the most abundant and most widely distributed of all the Antarctic species. Wheeler (1934) collected several hundred specimens at South Geor-

[1] Contributions from the Scripps Institution of Oceanography, new ser., no. 435. Received July 18, 1949.

gia, South Shetlands, South Orkneys, Anvers Island, East Falkland Island, and from dredge hauls at intermediate stations. The species was found from low water mark to a depth of 270 meters.

On the Navy Antarctic Expedition this species was collected at the following stations by D. C. Nutt: Off Cape Royds, Ross Island, January 29, 1948, 116 meters, 8 specimens; Marguerite Bay, February 22, 1948, 80 meters, 37 specimens; Marguerite Bay, February 20, 1948, 70 meters, 9 specimens.

The following additional representatives of this order have been reported previously from South Georgia, Falkland Islands, and from dredging stations in the South Atlantic and Antarctic Oceans: *Baseodiscus antarcticus* Baylis, 1915; *Parapolia grytvikenensis* Wheeler, 1934; *Lineus longifissus* (Hubrecht), 1887; *L. scotti* Baylis, 1915 (*L. roseocephalus* Wheeler); *L. magelhaensicus* Bürger, 1895; *Cerebratulus johnstoni* Wheeler, 1940; *C. larseni* Wheeler, 1934; and *C. malvini* Wheeler, 1934.

Order HOPLONEMERTEA

Amphiporus gerlachei Bürger, 1904

A. gerlachei Wheeler, 1934.

The body is moderately slender and pink or rosy in color. Length of body 16 to 25 mm, width 2 to 3 mm. Bürger (1904) has published a colored figure of the living worm. Each side of the head is provided with two groups of large ocelli. The cerebral sense organs are large and are situated beside the brain. The armature of the proboscis consists of a relatively large, pear-shaped basis and 2 pouches, each containing 2 to 7 accessory stylets. There are 12 proboscidial nervee.

Geographical distribution: The specimen studied by Bürger was dredged near the ice shelf west of Charcot Island at a depth of about 500 meters. The considerable number examined by Wheeler (1934) came from depths of 161 to 208 meters in the vicinity of the Falkland Islands. The single specimen collected by D. C. Nutt on the Navy Antarctic Expedition was dredged at a depth of 80 meters near Marguerite Island. At all these localities the species was associated with *Lineus corrugatus*.

Amphiporus spinosus Bürger, 1893

A. spinosus Wheeler, 1934, 1940.

Examination of a large number of living individuals by Wheeler (1934) convinced him that this species is more variable morphologically than any other member of the genus at present known. Particularly variable are the number of pouches of accessory stylets in the proboscis and the number of proboscidial nerves. According to Wheeler's report, the accessory pouches in different individuals may vary from 2 to 22, with 1 to 3 stylets in each. If numerous, they may occupy the entire circumference of the proboscis. He found the number of proboscidial nerves to vary from 11 to 26.

The body is nearly cylindrical and may reach a length of 180 mm. The color in life is stated to be pale pink, pinkish red, brick red, or orange. Ocelli are minute but very numerous, occurring as a broad, dense patch on each side of head anterior to brain, with a few others scattered on dorsal side of brain region.

Wheeler (1934) concluded that the great variability in the proboscis armature is responsible for the several specific names that the species has been given by Bürger and Joubin. He has listed *A. spinosissimus* Bürger, *A. cruciatus* Bürger, and *A. multihastatus* Joubin as synonyms. Since in all the other known species of this genus there is relatively little variability in the proboscis armature, it may be suspected that further study of living material will prove that one or more of these names actually represent valid species.

Geographical distribution: The species has been collected over a wide area in the Antarctic. It was found in abundance among kelp holdfasts at South Georgia, and has been dredged at depths of up to 270 meters in the adjacent seas. One specimen was dredged by the Navy Antarctic Expedition off Cape Ross at a depth of 116 meters, January 29, 1948.

Tetrastemma amphiporoides Bürger, 1893

This species was first described by Bürger (1893) from South Georgia but was not mentioned by Wheeler (1934). Seven specimens were obtained by the Navy Antarctic Expedition. Each of these is about 20 mm long and 3 mm in width. The body is slender and flattened, with four large ocelli on the head. Bürger describes the color in life as dark violet dorsally and orange on ventral surface. In color the species is similar to *T. validum*, but the shape of body, general appearance, and internal anatomy differ. The armature of the proboscis consists of a conical basis, of approximately equal length to the

sharply pointed central stylet, and two pouches with usually four stylets in each. There are 10 or 12 proboscidial nerves.

Geographical distribution: Dredged by the Navy Antarctic Expedition near Peter I Island at a depth of 60 meters by D. C. Nutt, February 15, 1948. Previously known only from the island of South Georgia.

Tetrastemma validum Bürger, 1893

T. validum Wheeler, 1934, 1940.

In form and color this is one of the most easily recognized of all species of nemerteans. The body is short and stout; rounded dorsally and flattened ventrally. The head is acutely pointed and separated from body by transverse lateral grooves. Color of dorsal surface is dark brown, with tinge of red, yellow, or purple. Ventral surface white, pale gray, pinkish or yellowish. In region of cephalic grooves the pale color of ventral surface extends dorsally to form a pair of conspicuous white lateral markings. These markings are broadly oval when body is extended but become sharply pointed dorsally when contracted. The internal anatomy is described in detail by Wheeler (1934), with a colored figure showing the characteristic markings of the living worm.

Twelve specimens of this species were collected by D. C. Nutt along the rocky shore of an island in Marguerite Bay. These specimens varied from 5 to 24 mm in length after preservation, although some of the living individuals mentioned by Wheeler (1934) were 35 to 40 mm long and 2.5 mm in width.

Geographical distribution: This is evidently a common species in the Antarctic region, for it has been collected also in Bransfield Strait, South Shetlands, at a depth of 200 meters, and in shallow water in the Palmer Archipelago, as well as near King Edward Cove, South Georgia (Wheeler 1934). Bürger first described the species from South Georgia.

The following additional representatives of this order have been reported from South Georgia, Falkland Islands, and the Antarctic region:

Amphiporus falklandicus Wheeler, 1934.
inexpectatus Wheeler, 1934.
lecointei Bürger, 1904.
marioni Hubrecht, 1887.
moseleyi Hubrecht, 1887 (*A. racovitzai* Bürger).
schollaerti Wheeler, 1934.
scoresbyi Wheeler, 1934.
Tetrastemma antarcticum Bürger, 1893.
duboisi Bürger, 1893.
Tetrastemma esbenseni Wheeler, 1934.
georgianum Bürger, 1893.
gulliveri Bürger, 1893.
hansi Bürger, 1893.
longistriatum Wheeler, 1934.
maivikenensis Wheeler, 1934.
stanleyi Wheeler, 1934.
unilineatum Joubin, 1910.
weddelli Wheeler, 1934.
Nemertopsella marri Wheeler, 1940.
Drepanophorella tasmani Wheeler, 1940.

It will be observed that among these 35 species at present known from the Antarctic, the only representatives of the Paleonemertea are 2 species of *Carinina*, although the Heteronemertea are represented by 9 species and the Hoplonemertea by 24 species. In comparison, there are 53 species recorded from the Atlantic coast of North America, of which 5 are paleonemerteans, 19 heteronemerteans, 28 hoplonemerteans, and 1 bdellonemertean. On the Pacific coast of North America there are 98 known species; 11 of these are paleonemerteans, 37 heteronemerteans, 49 hoplonemerteans, and 1 bdellonemertean. The Antarctic nemertean fauna therefore does not differ widely from that of other regions, for with one exception the genera are identical and the proportionate representation of the species among the orders is in reasonably close agreement. All the species, however, appear to be peculiar to the Antarctic.

Although the temperature of the water remains below 0° C. even in midsummer in some of these areas, the nemertean population is almost as large and the mature individuals of approximately the same size as in related species living in regions of more moderate temperature.

REFERENCES

Baylis, H. A. *Nemertinea*. British Antarctic Exped., 1910, Zool. **2**: 113–134. 1915.

Bürger, Otto. *Südgeorgischer und andere exotische Nemertinen*. Zool. Jahrb., Abt.-Syst., **7**: 207–240. 1893.

———. *Nemertinen*. Expéd. Antarctique Belge: Résults du voyage du S. Y. *Belgica* en 1897–1899. Rap. Sci. Comm. *Belgica*, Zool.: 1–10. 1904.

Coe, Wesley R. *Revision of the nemertean fauna of the Pacific coasts of North, Central and northern South America*. Allan Hancock Pacific Exped. **2**: 247–323. 1940.

Hubrecht, A. A. W. *Report on the Nemertea collected by H. M. S.* Challenger, *1873–76*. Rep. Sci. Res. *Challenger* **19**: 1–151. 1887.

JOUBIN, L. *Némertiens*. Deuxième Expéd. Antarct. Francaise, 1908–10: 1–33. 1914.

WHEELER, J. G. F. *Nemerteans from the South Atlantic and southern oceans*. *Discovery* Reports **9**: 215–294. 1934.

———. *Nemerteans of Kerguelen and the Southern Ocean*. British, Australian, New Zealand Antarctic Res. Exped. 1929–31 **4**: 233–256. 1940.

ZOOLOGY.—*A new precious coral from North Borneo.*[1] FREDERICK M. BAYER, U. S. National Museum. (Communicated by FENNER A. CHACE, JR.)

The Octocorallia collected during the Philippine cruise of the U. S. Fish Commission steamer *Albatross* have as yet not been reported upon, but preliminary studies indicate that the collection is one of great interest, and the number of species represented will probably be considerable. Although the collection contains only a single precious coral, it has proved to be new. In order to provide a complete key to the Indo-Pacific Coralliums for another report in preparation, it becomes necessary to describe it at this time, in advance of a complete report on the Philippine collection.

Although this new *Corallium* was obtained off North Borneo, not a single specimen was secured in the nearby Philippine waters. The absence of precious corals from collections made in the Philippine Archipelago is probably due to the fact that tangles were not used in the dredging operations. Most species of *Corallium* inhabit rocky ground where standard dredges and trawls are ineffective in securing fixed organisms. Seale (1911, p. 305; 1917, p. 204) states that a few small specimens have been found on the beach at Mindanao; since several species are more or less abundant in Japan, and three are now known from the Moluccas and Borneo, it seems likely that *Corallium* will eventually be found more or less abundantly in the Philippine Archipelago.

Corallium borneënse, n. sp.

Diagnosis.—*Corallium* branched on all sides; axis solid, striated, round except at twig tips where it is **X**- or **Y**-shaped in cross section; autozooids large, wartlike, set singly or in small groups, usually clustered on twig tips; siphonozooids minute, surrounding autozooids; coenenchyma papillate. Spicules: smooth double clubs, 6-, 7-, 8-radiates and crosses in both rind and verrucae; small rods with simple warts in verrucae only. Color in alcohol: rind salmon, verrucae flame scarlet (Ridgway, 1886, pl. 7); axis white with pink center.

Type.—U.S.N.M. no 49325, Sibuko Bay, British North Borneo: off Si Amil Island north 74° west, 5.4 miles (4°17′40″ N., 118°57′42″ E.), 292 fathoms, fine sand and green mud, bottom temperature 44.3°F. (*Albatross* station 5584, September 27, 1909).

Description.—The type is 5.5 cm in height, possibly only a branch of a large colony. The main axis is about 9 mm in diameter near the base, decreasing to 3.5 mm at the top. About 15 mm from the base there is a round hole 3 mm in diameter leading to a cavity within the stem; at the base of a branch 6 mm above the first hole there is a small but deep pit not connected with the axial cavity. These deformities were probably caused by a polychaete commensal. The axis is obscurely striated, round except at the twig tips where is is **X**- or **Y**-shaped in cross section. Branches are given off on all sides of the stem, projecting at right angles or inclined a little upward. The large branches irregularly subdivide into thick, clavate twigs which bear at their ends clusters of several autozooids; the small branches are mostly simple and of about the same calibre as the secondary twigs of the large branches. The autozooid calyces are low warts about 2 mm in diameter; very few occur on the main stem, but on the branches they are numerous, appearing singly or in groups of two or three, well separated. Twigs and branches terminate distally in a group of autozooids. There appears to be no predominance of autozooids on any one side; calyces may occur all around, or along any side. The siphonozooids are visible as small warts with simple orifices, often of a lighter color than the surrounding coenenchyma, situated around the bases of the autozooid calyces. The surface of the coenenchyma is papillate, but the character of the minute verrucae remains to be determined; it is possible that they also are siphonozooids, but

[1] Published by permission of the Secretary of the Smithsonian Institution. Received September 6, 1949.

more likely that they are only cnidal papillae. Unfortunately, the material at hand is not sufficient to permit the sectioning necessary to determine the answer, nor to investigate the canal system.

In spiculation *Corallium borneënse* is quite distinct. In both coenenchyma and verrucae the predominant form is the "double club" (Fig. 1, *b*, *c*, *j–m*), a highly modified sexradiate spicule with two of the arms greatly enlarged, forming a coalescent pair of spheroids (the club "heads"), two arms unmodified (forming the "handles" of the clubs), and the remaining two arms rudimentary, sometimes reduced to an inconspicuous irregularity of the spicule surface. Less common are the radiate forms with six (Fig. 1, *i*, *o*, *p*), seven (Fig. 1, *g*, *n*), or eight (Fig. 1, *f*) arms (imperfect forms are frequent among the radiate sclerites, such as the malformed octoradiate shown on Fig. 1, *q*), and simple crosses. Small rods with conical processes (Fig. 1, *e*) occur only in the calyces; this form seems to be derived from the multiradiate type by suppression of the arms.

Corallium borneënse is highly colored, the coenenchyma being nearest to Ridgway's "salmon" and the verrucae darker, approximating "flame scarlet." The white axis has a pink center.

Remarks.—The genus *Corallium* breaks down

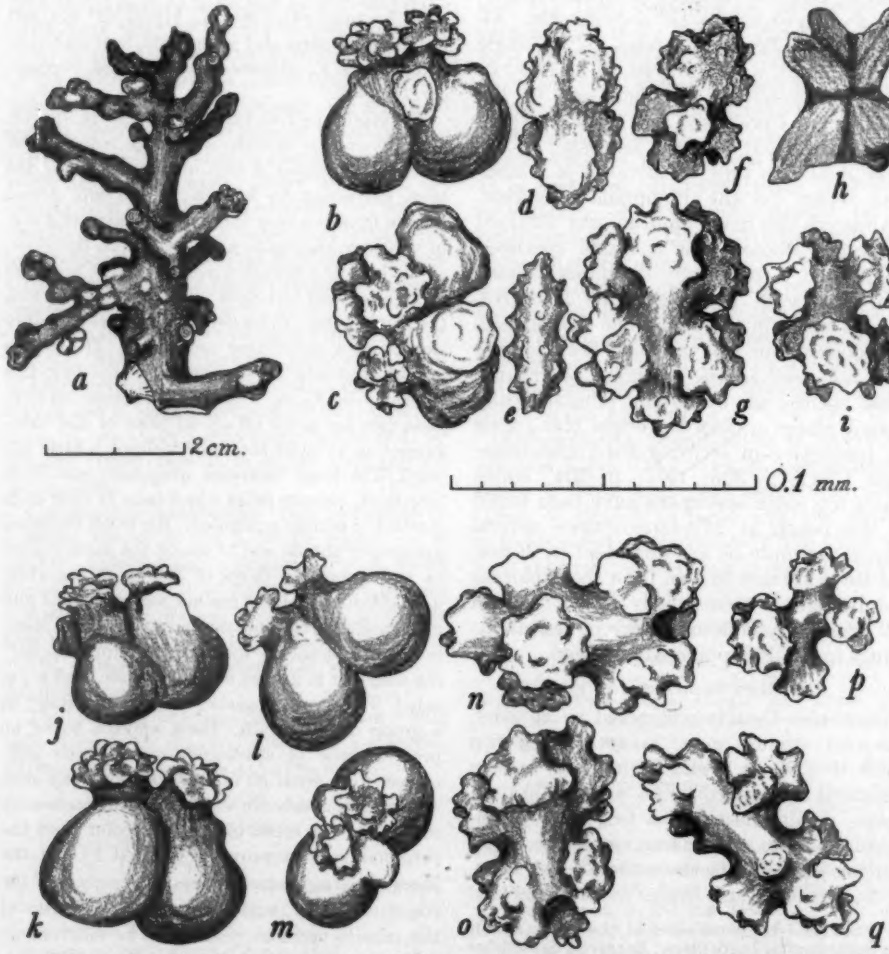


FIG. 1.—*Corallium borneënse*, n. sp.: *a*, Entire specimen; *b–i*, spicules from autozooid calyx; *j–q*, spicules from the coenenchyma.

on the basis of macroscopic features into four groups. (1) Those with the autozooids recessed into deep pits in the calcareous axis (e. g., *C. stylasteroides* Ridley). (2) Those with evenly distributed low, wart-like verrucae not appreciably recessed into the axis (e. g., *C. elatius* Ridley). (3) Those with high, tubular, sulcate calyces not recessed into the axis (e. g., *C. sulcatum* Kishinouye). (4) Those with rather large, dome-like verrucae often clustered in groups and also not set into the axis (e. g., *C. kōnojōi* Kishinouye). The new species just described falls into the fourth group, and except for the manner of branching is similar in appearance to *Corallium kōnojōi*. Microscopically the latter differs greatly in the predominance of sexradiates, the more irregular double clubs, and the presence of autozooids only on the "front" surface of the colony.

LITERATURE

HICKSON, S. J. *Die Alcyoniden der Siboga-Expedition. I. Coralliidae.* Siboga-Exped. **13c**: 1–7, pl. 1. 1907.

KISHINOUYE, K. *Preliminary note on the Coralliidae of Japan.* Zool. Anz. **26**(705): 623–626. 1903.

———. *Notes on the natural history of corals.* Journ. Imp. Fish. Bur. Tokyo **14**(1): 1–32, 4 figs., pls. 1–9. 1904.

KÜKENTHAL, W. *Gorgonaria.* Das Tierreich **47**: i–xxviii + 1–478. Berlin and Leipzig, 1924.

MOROFF, TH. *Studien über Octocorallien. II. Ueber einige neue Gorgonaceen aus Japan.* Zool. Jahrb., Abt. Syst., **17**(3): 404–410, pl. 16–18. 1902.

RIDGWAY, ROBERT. *A nomenclature of colors for naturalists* etc.: 1–129, pls. 1–17. Boston, 1886.

SEALE, ALVIN. *The fishery resources of the Philippine Islands. Part 4, miscellaneous marine products.* Philippine Journ. Sci. (D) **6**(6): 283–320, pls. 1–12. 1911.

———. *Sea products of Mindanao and Sulu, III: Sponges, tortoise shell, corals, and trepang.* Philippine Journ. Sci. (D) **12**(4): 191–210, pls. 1–4. 1917.

THOMSON, J. A., AND W. D. HENDERSON. *Alcyonarians collected by the Investigator, I. The Alcyonarians of the deep sea:* i–xvi + 1–132, pls. 1–10. Calcutta, 1906.

SCIENCE PUBLICATION.—*Microfilms as publication.*[1] G. WINSTON SINCLAIR, University of Michigan. (Communicated by RICHARD E. BLACKWELDER.)

In June 1948 Aurèle La Rocque was graduated by the University of Michigan, doctor of philosophy in geology. Immediately after his graduation his doctoral thesis, *Pre-Traverse Devonian pelecypods of Michigan*, was sent (in accordance with the regulations of the Graduate School) to University Microfilms, a private organization located in Ann Arbor. They prepared a microfilm negative of the thesis and returned the typescript to the University Library, where it is preserved. A copy of the microfilm was sent to the Library of Congress, which catalogued it and distributed cards to depository libraries. Copyright was secured, in La Rocque's name. University Microfilms then distributed, as pages 116–117 of their *Microfilm Abstracts*, volume 8, part 2, an abstract of the thesis (prepared by La Rocque) and announced that copies of the complete thesis, identified as "University Microfilms Publication 1059," could be purchased from them at $2.88.

In this thesis La Rocque describes three new genera and 14 species of pelecypods. Are these names to be considered published in zoological nomenclature?

I have chosen this example to illustrate a situation that is becoming more common and on which taxonomists should have some agreed policy. The scope of the problem is indicated by the fact that the one agency mentioned, University Microfilms, has already "published" over 1,400 theses, originating in 14 colleges and universities. Most of these do not deal with zoological subjects, but some do, and more may be expected to be added each year. In order to provide background for intelligent discussion, it might be well to go into some of the details of procedure in microfilm publication.

Availability.—The test applied in deciding whether printed material has been validly published is: Are the results available to other workers? Two considerations arise here. The question of literal availability is easily answered. Any library or individual may purchase La Rocque's paper for $2.88, with no restriction on use or citation, apart from that implied in the fact that it is copyrighted. Availability, however, also implies

[1] Received October 10, 1949.

that other workers know that the work exists and may be bought (or asked for). If I write a book, and distribute copies to my friends, then I have not published it, even though I might be glad to send a copy to a stranger if he should hear about it and ask for it. Sufficient public notice must be made to ensure that all potentially interested persons have a chance to learn of the work. University Microfilms' *Microfilm Abstracts*, essentially a publisher's catalogue in which the theses are priced and identified by a publication number, is distributed twice a year to about 450 libraries and abstracting agencies and is available to any library or institution wishing it. (A nominal price is set on this publication, but I understand that it is supplied to most libraries without charge.)

Edition.—A book publisher tries to estimate how many copies of a work will be needed, prints that number, and normally does not reprint it unless he has greatly underestimated the demand. This makes the size of the edition important, and a work of which very few copies were printed might be held to be invalid in nomenclature. The nature of microfilming demands new concepts. Since it costs no more, per copy, to make a microfilm copy tomorrow rather than today, there is no reason to make the 100th, or 500th, copy until someone orders it. If it is not asked for, then the expense of making it is saved. This means that if no orders are received for La Rocque's thesis, then University Microfilms' Publication 1059 has an edition of one, the one sent to the Library of Congress. But if 523 orders are received, then there is an edition of 524. And the edition is never closed, so long as the negative exists and some agency is willing to make copies of it.

Inconvenience.—Many workers are sufficiently old-fashioned (or sale-resistant) to object to microfilm except as an emergency tool in research. Since inconvenience in use is sometimes raised as an argument against acceptance of microfilm as publication, it should be mentioned that the publishers offer to provide a full-size copy of a whole paper, or selected parts (such as plates or illustrations), to anyone willing to pay the cost, 10 cents per page. Of course, this is expensive, but not much more so than the per-page cost of the Opinions of the International Commission on Zoological Nomenclature. The cost of the microfilm itself, $1\frac{1}{4}$ cents per page, would seem low enough to rule out objection on that score.

If in drawing up these notes I seem to be advocating acceptance of microfilmed work, it is simply because I find many taxonomists tend to shrug off any such suggestion without consideration. I hope that I have shown the problem as a real one. Three courses would seem open:

1. To decide that microfilm is not acceptable publication in taxonomy. Such a decision should be based on very careful consideration. The indefinite size of the edition would seem, to me, to afford the soundest grounds for objection.

2. To decide that microfilming is a valid means of publishing taxonomic material. This would mean treating each microfilming agency as we would any new journal or serial, making sure that the abstracting journals in which we are interested see copies of relevant papers, having our libraries place continuing orders for work in fields which concern us, etc.

3. To consider microfilming a valid but undesirable means of publication, to be discouraged. Since the actual publishers have no interest in the contents of their publications, this would mean convincing individual university faculties that theses in which new taxonomic units are proposed should not be sent for microfilming. The responsibility for abstracting and review would remain.

I am asking the Joint Committee for Zoological Nomenclature for Paleontology in America to discuss the problem. This note is published in the belief that other groups will wish to join the paleontologists in considering it and eventually in arriving at a concerted opinion.

PROCEEDINGS OF THE ACADEMY

433D MEETING OF BOARD OF MANAGERS

The 433d meeting of the Board of Managers, held in the Cosmos Club on December 12, 1949, was called to order at 8:01 P.M. by the President, FRANK H. H. ROBERTS, JR. Others present were: F. B. SILSBEE, H. S. RAPPLEYE, F. G. BRICKWEDDE, W. W. DIEHL, F. M. DEFANDORF, W. N. FENTON, C. L. GAZIN, F. E. JOHNSTON, W. A. DAYTON, MARGARET PITTMAN, H. W. HEMPLE, H. G. DORSEY, F. M. SETZLER, and, by invitation, H. E. MCCOMB, HERBERT FRIEDMANN, J. L. SHERESHEFSKY, and F. L. MOHLER.

The President announced the appointment of JOSEPH M. CALDWELL to serve the unexpired term of the late FRANK THONE on the Committee on Encouragement of Science Talent to January 1951, and of FRANK M. SETZLER to serve Mr. Thone's unexpired term as representative on the Council of the American Association for the Advancement of Science, also to January 1951.

The Board approved the recommendation of the Committee on Meetings to hold the annual meeting of the Academy on Saturday, January 28, 1950, this to be a dinner meeting at Hotel 2400.

The Committee on Membership submitted the names of 11 persons for resident membership.

The General Chairman of the Committee on Awards for Scientific Achievement, W. A. DAYTON, presented the results of the decisions of the various subcommittees and made the following three recommendations for the 1949 Academy Awards, which were unanimously accepted by the Board:

Biological Sciences: Dr. EDWARD G. HAMPP, of the National Institutes of Health, in recognition of his original and fundamental contributions to the knowledge of diseases of the oral cavity, and particularly because of his being the first to isolate in pure culture *Borrelia vincentii*, thus making possible new approaches to the study of spirochetes.

Engineering Sciences: Dr. RICHARD K. COOK, of the National Bureau of Standards, in recognition of his distinguished service in acoustics and his method of absolute calibration of microphones.

Physical Sciences: Dr. JOHN A. HIPPLE, of the National Bureau of Standards, in recognition of his distinguished service in advances in mass spectrometry and in the precise measurement of atomic constants.

Mr. DAYTON informed the Board that members of his Committee had discussed the possibility of offering more than one award each year. He also suggested that the future chairman of the Award Committee be instructed to recommend an award each year for the biological sciences.

The Secretary reported that a check for $400 had been received from the American Association for the Advancement of Science to cover the two grants-in-aid recommended by the Committee on Grants-in-Aid for Research and approved by the Board at its meeting on November 14, 1949.

W. N. FENTON, Chairman of the Committee on the Index of the Journal, reported that the first seven volumes have been completely indexed and the cards turned in to PAUL H. OEHSER, who is immediately supervising the work. Miss MARY A. BRADLEY, the indexer, informed the Committee that she expected to have completed by the first of the year the first 15 volumes, as contracted.

The Secretary reported the following deaths: JOHN TUCKER, Jr., National Bureau of Standards, on November 20, 1949 (elected May 16, 1941); and HOBERT C. DICKINSON, formerly of the National Bureau of Standards, on November 27, 1949 (elected April 8, 1912; on retired list December 31, 1945).

MARGARET PITTMAN read a proposal from B. J. OLSON suggesting the possibility of scientific symposia being sponsored by the Academy and its affiliated societies. The Board recalled that a previous committee had considered holding such symposia but found that the cost of arranging for them and publishing the results would be more than the Academy could afford. The Board voted to refer this report to next year's Committee on Meetings for consideration.

The meeting adjourned at 9:23 P.M.

F. M. SETZLER, *Secretary.*

Obituary

JOHN MONTGOMERY COOPER, head of the department of anthropology at Catholic University of America, died in Washington, D. C., on May 22, 1949, of coronary thrombosis. Father Cooper held a place in the hearts of American scientists that is unique for an anthropologist at least. There were many facets to the man's personality—priest, social worker, public servant, educator, organizer of learning, councillor to the foundations and learned societies, and confidant of the younger anthropologists. Others will recall generosity, charity, and a glorious sense of humor that enlivened the conference room, the lecture hall, and sessions with Indian informants. Children, Indians, and his colleagues loved him in that order.

The Coopers were an old Maryland family, and Father Cooper was a life-long resident of the Washington area. Born at Rockville, Md., October 28, 1881, son of James Joseph Cooper and Emma Lillie (Toulou), he prepared at Calvert Hall, Baltimore, for St. Charles College, and went on to the American College in Rome, Italy, where he took the Ph.D. (1902) and the S.T.D. three years later. Classical art and archeology formed his first scholarly interest.

Before joining the faculty of Catholic University in 1909, and concurrently 1905–1918, Father Cooper served as assistant pastor of St. Mathews Church, where he was active in boys' work. As a student he had been an avid boxer, and he gave up tennis much later. His record in social work led to the appointment as director of camp and community activities for the National Catholic War Council, 1918–1920.

For two decades his teaching was in the field of religious education. To this period may be assigned books published between 1923 and 1930, not to mention articles on theology, and a report on *Children's institutions* (1930).

An associate professor in 1923, within five years he was elevated to professor of anthropology in the sociology department, with a separate department in 1935. Cooper trained few graduate students in anthropology by some university standards, but his influence extended widely here and abroad. Many of the present generation of working anthropologists can recall his kind words about a first paper read before a professional meeting, and no contribution was too insignificant not to merit a handwritten note of cordial congratulation. Nor was he above going to the field with younger men and sharing methods of observation and interview.

When there were working jobs to do, Cooper did not shirk, and he got a fair share of *kudos*. The minute books of the Anthropological Society of Washington attest to his conscientious industry as secretary during five terms; he was president during 1930–32. The American Anthropological Association meanwhile made him its secretary and elected him president, 1940. Likewise, he was vice-president of the American Folklore Society, 1943; fellow of the American Association for the Advancement of Science, recipient of the Mendel Medal, 1939, and a monsignor of the Catholic Church, 1941.

Of the Catholic Anthropological Conference he was founder and director of its fortunes from 1926 until his passing. *Primitive man* (22 vols.) was Cooper's journal, as was the *Anthropological Series* of his university. Some 14 numbers have appeared, many of which were written, and all edited, by the man himself.

His contributions to science were of a high order. In compiling the *Analytical and critical bibliography of the tribes of Tierra del Fuego* . . . (1917), Cooper developed a method of cultural analysis and an interest in the marginal tribes of the world with which his name will remain associated. Anthropological scholarship has seldom since attained the level set in this first monograph. But he was no mere library scholar.

Field work took him repeatedly to the Algonquian hunters of the Canadian Northeast and among the Gros Ventre of the Northern Plains. He brought training in theology to the study of primitive religious culture, publishing studies of divination (1928) and the Supreme Being (1934); and he was attracted as well to such mundane topics as "Snares and Deadfalls" (1938) and to a critical examination of whether the family hunting territory system of the northern peoples is pre-Columbian (1939). Cultural history and the South American area reclaimed his attention in recent years. Two theoretical papers on areal and temporal aspects of South American culture and of the northern arboreal hunters were followed by five ethnographic contributious on South American hunters in volume 1 and four topical studies in volume 5 of the *Handbook of South American Indians*. He considered it a great joke on himself to be doing "games and gambling" and "stimulants and narcotics."

WILLIAM N. FENTON.